THE

PENNY CYCLOPÆDIA

OF

THE SOCIETY

FOR THE

DIFFUSION OF USEFUL KNOWLEDGE.

VOLUME XXIII.

STEARIC ACID——TAGUS.

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STEARIC ACID. This substance is procured from stearin [STEARIN], which is a compound of stearic acid and a peculiar sweet substance called glycerin, which is treated of under the head of SOAP.

When stearin is saponified by potash, stearate of potash is procured; and when warm dilute hydrochloric acid is added to the solution, the stearate is decomposed, chloride of potassium remains in solution, and the stearic acid is precipitated.

The properties of this acid are, that it has the form of brilliant white scaly crystals; it is inodorous, tasteless, insoluble in water, soluble in its own weight of æther and in hot alcohol, and the solution reddens litmus-paper; but its acid action is feeble, for it expels carbonic acid from the alkaline carbonates only at a boiling heat. It melts at about 158° Fahrenheit and on cooling it forms a crystalline mass: it is volatile, and may be distilled unaltered in close vessels. In the air it burns like wax. Its composition is somewhat differently stated by authors, but no one statement differs much from—

68 equivalents of carbon	.	408	79·4
66 equivalents of hydrogen	.	66	12·8
5 equivalents of oxygen	.	40	7·8
Equivalent		514	100·

In the state of crystals it contains two equivalents of water = 18, or nearly 3·4 per cent. It forms compounds with the alkalis, earths, and metallic oxides, which are called *stearates*.

Stearate of Ammonia.—Stearic acid absorbs ammoniacal gas; the resulting compound is white, inodorous, and has an alkaline taste. It is dissolved by boiling water, and the solution, on cooling, deposits pearly crystals of stearate of ammonia.

Di-stearate of Potash is formed by boiling equal weights of the acid and alkali dissolved in five times their weight of water. It forms a white granular compound, which is opaque, and may be purified by solution in boiling alcohol; as the solution cools, the salt separates in white brilliant scales. This compound may also be procured by treating potash soap with alcohol.

It is composed of—

One equivalent of stearic acid	.	514
Two equivalents of potash	.	96
Equivalent		610

Stearate of Potash is obtained by dissolving one part of potash soap made with suet and caustic potash, in six of hot water, and then adding about ten times their weight of cold water to the solution; the precipitate which results contains the stearate of potash mixed with margarate of the same base; from the latter it is separated by repeated treatment with alcohol, and is then obtained in soft silvery crystalline scales.

It is composed of—

One equivalent of stearic acid	.	514
One equivalent of potash	.	48
Equivalent		562

Di-stearate of Soda and stearate of soda may be obtained by processes similar to those described for the stearates of potash; they are less soluble than the salts of potash, and enter into the composition of hard soaps.

Stearate of Lime, Stearate of Barytes, and *Stearate of Lead,* are all white insoluble powders, and are not applied to any useful purpose.

Stearic Acid, besides its use in the manufacture of soap, is now very largely employed in the making of candles.

STEARIN (from στέαρ, *fat*) is the harder portion of animal fats; olein, or elain, being the softer one. To obtain stearin in a pure state, mutton-suet is to be melted with ten times its weight of æther in a water bath; as the solution cools, crystals of stearin are deposited, which, after washing with cold æther, are to be strongly pressed.

The properties of stearin are, that it has a pearly lustre, is soft to the touch, but not greasy; it melts at about 140° to 145° Fahrenheit; and, on cooling, solidifies into a mass, like wax, which is not crystalline in its texture, and is reducible to powder. Stearin is insoluble in water, but is dissolved both by hot alcohol and æther, from which it almost entirely separates on cooling; it possesses weak acid properties, and may be combined with potash; it is the chief and most important ingredient of the harder kinds of fat, and the harder they are the more they contain.

Stearin is separable into two different principles, namely stearic acid and glycerin, as has already been noticed in the preceding article; it appears to be a bi-stearate of glycerin, consisting of—

Two equivalents of stearic acid	.	.	1028
One equivalent of glycerin	.	.	83
Two equivalents of water	.	.	18
Equivalent			1129

The composition of stearic acid has already been given: glycerin is composed of, probably—

Six equivalents of carbon	.	.	36
Seven equivalents of hydrogen	.		7
Five equivalents of oxygen	.	.	40
Equivalent			83

STEARON is obtained by the partial decomposition of stearic acid; when distilled with lime, carbonic acid is formed, and the stearon produced at the same time is volatilized, and condenses in the state of a volatile liquid: it appears to consist of—

Sixty-six equivalents of carbon	.	396
Sixty-six equivalents of hydrogen	.	66
One equivalent of oxygen	.	8
Equivalent		470

So that it seems to be stearic acid deprived of two equivalents of carbonic acid.

STEAROPTEN. Volatile oils, as obtained by distillation from plants, appear, like expressed oils, to consist of two substances; one solid, which has received the name of *stearopten*, and the other liquid, called *elaopten*: the former generally crystallizes when the oil has been long kept.

Camphor is the most remarkable substance of the class of stearoptens. It is obtained by distillation with water, and in the plant is mixed with camphor oil, from the gradual oxidation of which it appears to be produced.

STEATITE, *Soapstone, Speckstein, Talc-Steatite.* This mineral, which is principally a hydrated silicate of magnesia, is met with massive in amorphous masses, which sometimes contain crystals of this substance of the form of quartz and calcareous spar, and which are probably pseudomorphous. Structure compact. Fracture uneven, splintery. Soft, and has a greasy feel. Colour yellowish, greenish, and greyish-white. Streak shining. Dull. Translucent on the edges. Specific gravity 2·604 to 2·632.

Before the blowpipe it is infusible either alone or with additions. It occurs plentifully in Baireuth, Saxony; in Cornwall, in Scotland, and many other parts of the world.

According to Klaproth it consists of—

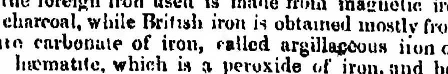
	Baireuth.	Cornwall.
Silica	59·50	45·00
Magnesia	30·50	24·75
Alumina	0·00	9·25
Oxide of iron	2·50	1·00
Water	5·50	18·00
	98·	98·

STEEL. Iron possesses many qualities which render it applicable to innumerable purposes in the arts; but there are some uses for which it is not sufficiently hard, and this defect is supplied by converting it into steel.

At Eisenärzt in Styria the manufacture of steel has been carried on ever since the eighth century, and yet the exact nature of the operation is perhaps even now imperfectly understood. It is generally admitted that steel is an intimate compound of iron and charcoal, for soft iron contains a considerable portion of charcoal, and it is by no means clear that the quantity is increased in the process of steel-making, and therefore we must conclude that some more intimate union is effected between them when iron is converted into steel. Whatever the theory may be, we shall now describe the mode in which the operation is conducted in this country, and principally at Sheffield.

In the first place it is to be observed that hitherto Swedish and Russian bar-iron have been exclusively employed in the manufacture of the best steel; the preference given to this iron is decided, though from what cause it arises has not been satisfactorily made out.* We may however remark that the foreign iron used is made from magnetic iron ore with charcoal, while British iron is obtained mostly from the impure carbonate of iron, called argillaceous iron ore, or from hæmatite, which is a peroxide of iron, and both of these are reduced by employing coal or coke prepared from it.

Bar-Steel is made, with few exceptions, from the Swedish and Russian iron, the bars of which are marked *hoop l* (1), *gl* (2), and *double bullet* (3); these, which are the best kinds, fetch from 31*l.* to 35*l.* per ton. Iron of lower quality is also used, such as (4), which is a Russian iron, and *c and crown* (5), *d and crown* (6), which are Swedish irons: these cost the importer about 20*l.* per ton; whilst there is a medium quality at about 25*l.* per ton, viz. *w and crowns* (7), *b and*



1 2 3 4 5 6 7 8

crown (8): these also are Swedish. These steel irons are imported almost exclusively by English merchants residing in Hull; the limited quantity of the fine iron allowed to be produced from the mines of Danemora in Sweden accounts in some degree for the high price at which they are sold. The quantity of iron, of the various qualities stated, which is imported into this country for the manufacture of steel is estimated at 12,000 to 15,000 tons, of which at least 9000 come from Sweden.

The usual operation in large steel-works is first to cut the bar-iron into certain lengths, leaving room in the vessels for the expansion of the iron, which amounts to $\frac{1}{16}$. The closed vessels in which the bars are heated are usually twelve feet in length, and divided into two pots or troughs, on the bottom of which the workman strews charcoal to the thickness of about an inch, and upon this he places on their flat side a layer of bars; then about three-fourths of an inch more of charcoal is added, and upon this he places another layer of bars, and so on till the troughs are filled; these are then covered with a ferruginous earth coming from the grinding-stones, called wheelswarf, to the thickness of about eight inches. All the apertures of the furnace are then closed with loose bricks and plastered over with fire clay. The fire is then lighted, and in four days and nights the furnace is at its full heat, at which it is kept for several days, according to the degree of hardness required. In order to be able to test the progress of the carbonization, a hole is left in one of the pots near the centre, and three or four bars are placed in the furnace in such a manner that the ends come through this opening, and after the sixth day one is pulled out. If the iron be then not sufficiently carbonized, the heating is continued from two to four days longer: a bar is drawn every two days, and when the iron is completely converted, the fire is heaped up with small-coal, and the furnace is left to burn out, and it requires from this period fourteen days' time to cool sufficiently to allow a person to go in and discharge the steel.

It is of the greatest importance that the pots or troughs be kept completely air-tight: the smallest crack will open when the furnace is hot, and admit the air: this of course frustrates the object of the operation, and any steel which has thus suffered is placed aside to be reconverted. It is of the greatest importance to give the iron the exact quantity of carbon required and no more.

1st. *For coach-springs.*—The iron must *not* be converted to the centre.

2nd. *For common cutlery, single and sheer steel*, and for purposes where steel has to be welded to itself or to iron, the conversion should be low, and gradually disseminated throughout the whole thickness of the bar.

3rd. *For double sheer steel*—the conversion should be somewhat harder than the preceding.

4th. *For files* and all instruments where resistance or fine cutting-edges are required, the conversion should be hard, and the iron fully carbonized throughout the bar, and the fracture should present small facets.

No definite rules can be laid down, nor can any distinct instructions be given to enable the uninitiated to judge of the temper or degree of hardness of a bar of steel; but by habit workmen soon acquire the means of distinguishing between the different degrees of hardness of two pieces of steel. This knowledge of the degree of temper is of great importance to the steel-maker, for though he is enabled to adapt the temper (hardness) of the steel to the wants of the manufacturer, a file, made from soft steel which would be valuable for welding purposes, would be useless in the arts, and a coach-spring made from steel hard enough to make a file could not be applied to its intended purpose.

A converting furnace contains generally fifteen tons of iron; and there are some large enough to hold eighteen to twenty tons. The bar-steel, when discharged from the furnace, is partially covered with small raised portions of the metal; and from the resemblance of these to blisters, the steel is called *blistered steel*. It has been supposed that these blisters arise from the expansion of carbonic oxide gas, formed and confined during the process of cementation; this however is not the case, for they evidently arise from the unsoundness of the iron, which is not throughout perfectly welded.

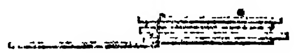
It has been found by the experiment of placing a bar of Swedish and one of Staffordshire bar-iron in the same furnace, that the former was much blistered, while the latter had scarcely any blisters larger than a pea. It must however be admitted that the cause of the blistering in one case, and its slight production in the other, are circumstances difficult of explanation.

At one time it was common for the steel-maker to receive orders for steel *well blistered*. This arose from a mistaken idea regarding the perfection of the steel, it being supposed that the more it was blistered, the more it was carbonized, and

* A patent has lately been obtained by Mr. Charles Sanderson for making iron fit for conversion into steel; from some instruments made from the steel so produced, now in the possession of the writer of this article, he is inclined to think favourably of the process.

consequently that its quality was indicated thereby; now however manufacturers are better informed, and steel so blistered is complained of.

Bar-steel as it comes from the converting furnace is used for various purposes without refining; those parts which are free from flaws and blisters are broken out and hammered or rolled to the sizes required by the manufacturer for files, edge-tools, table knives and forks, and coach-springs, and a great variety of common agricultural implements. It is also manufactured into what is called *single and double sheer steel;* for this purpose the converted bar is selected of equal degree of hardness, and broken into pieces of about two feet in length; these are taken to the forge, heated to a full cherry red, and hammered into bars two inches by three-quarters of an inch in thickness; six of these pieces are put together and kept firmly so by a hoop, which is fixed at the end of a handle, thus—



they are then placed in a hollow fire urged by a soft blast, and heated gradually up to a full welding heat, during which the workman covers the surface with clay beaten very fine; this runs over the surface, and to some extent prevents oxidation. When fully heated, they are placed under the hammer, carefully welded together and drawn into a bar of about two inches square at the same heat; the other end is then put into the fire and welded in the same way; this is termed *single* sheer steel. It is made *double* by nicking the bar in the middle and doubling it together, giving a second welding heat and drawing it out as before to a bar of about two inches square; it is then *hammered, tilted,* or *rolled* to the size required; by this process *bar steel* becomes more homogeneous, of a finer texture, and any instrument made of it will receive and retain a finer edge; the steel is also rendered much tougher, which is supposed to arise from the abstraction of a small portion of carbon, and the mechanical elongation of the fibre by these doublings, &c.

Manufacture of Cast Steel.—The fabrication of *cast steel* is comparatively a recent invention. It was first made by Mr. Huntsman, at Attercliff, near Sheffield, in 1770, since which time the manufacture of it has very much increased, and it is daily superseding the use of bar or shear steel, on account of the equality of its temper, and the superior quality as well as beauty of the articles which are made of it. The process adopted is that of taking bar steel converted to a certain degree of hardness and breaking it into pieces of about a pound each; a crucible charged with these is placed in the melting-furnace, similar to that used by brass founders. The cellar is usually arched, and the stacks are about 40 feet high; the furnaces are 20 inches long by 16 inches wide, and 3 feet deep. The most intense heat is kept up for two hours and a half or three hours, coke being used as fuel. When the furnace requires feeding, the workman takes the opportunity of lifting the lid of each crucible and judging how long the charge of each will be before it is completely melted: all the crucibles are usually ready about the same time; they are taken out of the furnace, and the liquid steel is poured into ingots of the shape and size required: the crucibles are immediately returned into the furnace; and when the contents of all have been poured into the moulds, the crucibles are again charged: they are used three times, and then rejected as useless. The ingots are taken to the forge-tilt or rolling-mill, and hammered into bars or rolled into sheets, as may be required. The celebrated *wootz*, or Indian steel, is cast-steel; but it is frequently so imperfect as to resemble cast-iron rather than cast-steel. It is however made of iron obtained, as the Swedish is, from the magnetic ore. Wootz is made by the natives from malleable iron, packed in small bits with wood in crucibles, which are then covered with some green leaves and clay: about two dozen of these crucibles are packed in one furnace; they are covered with fuel, and a blast given for about two hours and a half, which terminates the operation. When the crucibles are cold, they are broken, and small cakes of steel are obtained in the form in which it comes to England.

Having stated the mode in which steel is prepared, we shall now give an account of its properties and composition, and a concise view of the theories of its formation.

The properties of steel are, that it is of a lighter grey colour than iron, and which is so characteristic as to be described as a *steel-grey:* it is susceptible of receiving a very high polish, and this is greater as the grain is finer. The density of steel before hammering or hardening varies from 7·73 to 7·81. Dr. Thomson found the density of good blistered steel to be 7·823; by heating it to redness and sudden immersion in cold water, the density was reduced to 7·747: a piece of soft cast-steel similarly treated was reduced in density from 7·8227 to 7·7532. It follows therefore that when steel is hardened its volume is increased. When steel is heated to redness and slowly cooled, it is scarcely harder than iron; but by very rapid cooling it becomes hard, and so brittle as to be readily broken. The fracture of steel is usually fine grained; in ductility and malleability it is much inferior to iron, but exceeds it greatly in elasticity and sonorousness. It may be subjected to a full red heat, or 2786 Fahr., without melting, and is therefore less fusible than cast-iron, but much more so than wrought-iron. Pieces of steel which have not been cast may be readily welded together or with iron; but after casting the operation is more difficult. Steel does not acquire magnetic polarity so readily as iron, but retains it much longer; by exposure however to a moderate degree of heat this power is lost.

In order to give to steel the different degrees of hardness required for the various purposes to which it is applied, it is subjected to the process of what is called *tempering*. It has been mentioned that steel is hardened by heating and sudden cooling; and it is found that the higher the temperature to which it is raised, and the more sudden the cooling, the greater is the hardness: thus when immersed in mercury the hardness is greatest, on account of the good conducting power of the metal, and its consequent ready abstraction of heat. After this comes acidulated water, salt water, common water, and lastly oily or fatty bodies. It is found that, according to the degree to which steel is tempered, it assumes various colours, and formerly these colours served as guides to the workman; now however a thermometer, with a bath of mercury or of oil, is employed, and the operation is performed with a much greater degree of certainty.

Into this bath the articles to be tempered are put, with the bulb of the thermometer graduated up to the boiling-point of mercury. The annexed are the tempering heats, colours, and uses of steel of different degrees of hardness:—

430° Fah.,	very faint yellow; for lancets.
450° ,,	pale straw; razors and surgeons' instruments.
470° ,,	full yellow; penknives.
490° ,,	brown; scissors and chissels for cutting cold iron.
510° ,,	brown with purple spots; axes and plane-irons.
530° ,,	purple; table-knives and large shears.
550° ,,	bright blue; swords, watch-springs, truss-springs, and bell-springs.
560° ,,	full blue; small fine saws, daggers, &c.
600° ,,	full blue, verging on black; this is the softest of all the gradations, and the steel is fit only for hand and pit saws.

The degree at which the respective colours and corresponding hardness are produced being thus known, the workman has only to heat the bath and its contents up to the required point.

The degree of hardness attainable by steel depends upon the temperature to which it is raised, and the coldness or conducting power of the liquid into which it is immersed: so that, as observed by Mr. Brande, if very cold water cannot be procured, the steel-die or other article must be heated proportionably high;* a dull red heat into water at 34°, a cherry-red into water at 50°, an orange heat into water at 80°, a dull white heat into water at 100°, produce nearly the same effects: a red heat and water at 45° is the most desirable for the hardening; and although by subsequent tempering the die may, if necessary, be *brought down* or softened, it is always safest to give it due hardness by the first operation. In some cases steel is sufficiently hardened before any change of colour is produced. Capt. Kater found that 212°, or the heat of boiling water, was the exact point at which the knife-edges attached to a pendulum were properly tempered. The colour produced on the surface of the steel is supposed to be derived from slight oxidizement; and it is stated in corroboration of this opinion, that when steel is heated and suffered to cool under mercury or oil, none of the colours appear; nor do they when it is heated in hydrogen or azotic gases: the cause however of the

different degrees of hardness produced at the same time with the changes of colour has not been hitherto satisfactorily explained.

Case-hardening is the operation by which articles made of malleable iron or cast-iron are superficially converted into steel by heating them with charcoal in a crucible.

With respect to the composition of steel and the nature of the admixture requisite to constitute it, differences of opinion have long existed, and the question even now is considered by some as hardly decided, whether carbon is indispensably necessary to its formation, and whether certain substances or metals, especially silicon, may not give rise to it; and it is generally admitted that phosphorus is always present. Berzelius mentions iron containing manganese as particularly eligible, and yet the analyses which we shall presently state show that this metal is not present in steel in most cases; but we have understood that it is so in the steel made in Germany from spathose iron-ore, or carbonate of iron.

An experiment performed and described by Mr. Pepys in the 'Phil. Trans.' for 1815, seems not only to prove the necessity of carbon, but also that the diamond is capable of producing the same effect. In order to get rid of the objection that the carbonaceous matter of a common fire might supply carbon when iron and diamond were heated by means of it, he placed diamond-powder in a piece of pure soft iron wire; and having properly secured it, he heated it by means of voltaic electricity: after a few minutes' heating, the diamond had disappeared, and the interior surface of the iron was converted into perfect blistered steel, which, being heated to redness and plunged into cold water, became so hard as to resist the file and scratch glass.

Some years since also a method was discovered by Mackintosh of converting iron into steel by means of the carbon of carburetted hydrogen gas.

The following are the results of four analyses of the cementation steel of Remmelsdorf, department of the Moselle, by Vauquelin:—

Iron	98·72	98·38	98·27	97·74
Carbon	0·79	0·12	0·79	0·63
Silicon	0·15	0·82	0·15	0·11
Phosphorus	0·34	00·68	0·79	1·52
	100·	100·	100·	100·

It appears from the following analyses of cast-steel by Gay Lussac that during fusion the steel loses much silicon and a little carbon: the samples analyzed were (1) English, first quality; (2), French, first quality; (3), French, second quality; (4), Isère.

	(1).	(2).	(3).	(4).
Iron	99·32	99·24	98·87	99·27
Carbon	0·62	0·65	0·94	0·65
Silicon	0·03	0·04	0·08	0·00
Phosphorus	0·03	0·07	0·11	0·08
	100·	100·	100·	100·

In the opinion of Mr. Brande, the quantity of carbon in the above-analyses is somewhat underrated; and he has found that when the carbon has fallen short of one per cent, the steel was deficient in hardness; and when it has exceeded this proportion, the dies have split or not stood their work. He states, at the same time, that minute quantities of other bodies appear to influence the quality of steel; and that unless it contain phosphorus it cannot be depended on for the manufacture of dies in coining.

Dr. Thomson examined some cast-steel furnished him by Mr. Buttray, a steel-maker near Glasgow: the general result of his trials gave him—

Iron	99
Carbon with some silicon . .	1
	100

and this composition, he observes, approaches 20 atoms of of iron + 1 atom of carbon, and this he thinks likely to be the constitution of cast-steel, an opinion corroborated by the fact above stated by Mr. Brande. Mr. Faraday and Mr. Stodart published in the 'Phil. Trans.' for 1822 a valuable series of experiments on alloys of steel, from which it appears that by combining steel with other metals its quality is improved: for the details we refer to the memoir, merely stating that a very minute addition was found sufficient to produce a good effect: thus one 500th of silver gave an alloy harder than cast-steel; one 100th of nickel gave a very hard alloy, susceptible of a fine polish: alloys of rhodium and platinum were also formed; and these, with the alloys of iridium, osmium, and palladium, formed the most valuable compounds.

STEEL ENGRAVING. In the article ENGRAVING [vol. ix., p. 437] the history of the art of engraving upon metallic plates for the purpose of producing prints, or impressions, in ink, upon paper and other substances, as well as the chief points requiring notice in the practice of the art, has been treated of; and therefore it merely remains in this place to notice such matters as refer to the use of steel plates, which have of late been very extensively and advantageously substituted for those of copper.

As far as regards facility of execution, whether by etching or by cutting with the graver, probably no material could be found superior to copper, which is still preferred by many engravers, where the fine and free character of the work is more important than the durability of the plate; but the comparative softness of copper occasions it to wear so rapidly in the process of printing, that the beauty of the engraving is very soon impaired, and it is impossible to produce, from a single plate, a sufficient number of impressions for the illustration of books of large circulation. It should be borne in mind that, in copper-plate printing, the whole surface of the plate is covered with thick unctuous ink, which is rubbed into the lines with a ball of cloth applied with considerable force. The superfluous ink is then wiped off with a rag, and the surface of the plate is thoroughly cleaned by repeated wiping or rubbing with the palm of the hand, so as to leave the ink only in the lines or incisions in the plate, from which it is transferred to the paper by very powerful pressure in a rolling-press. This operation, being repeated with every impression, tends to the rapid deterioration of the plate, the surface of which is so worn by the constant friction, that the finest lines soon disappear, while the edges of the widest and deepest incisions become so rounded that they will not contain the proper quantity of ink. Hence it becomes necessary, where many impressions are required, to retouch and deepen the engraving after printing a few hundred copies; but even this measure, troublesome and expensive as it is, will not restore the engraving to its original beauty. The use of steel plates for diminishing this inconvenience, although not extensively resorted to until within the last twenty years, is a measure of which the possibility was conceived at an early period. It is believed that Albert Dürer, who also made experiments upon plates of tin, silver, &c., engraved a few steel plates; impressions of which, or of some of which, are preserved in the collection of the works of that artist in the British Museum. They appear to be executed chiefly, if not entirely, by the process of *etching*. Probably many other engravers may have tried engraving upon steel, but the difficulty of cutting it, on account of its hardness, and the want of a good menstruum for the purpose of etching, prevented the accomplishment of anything important in steel engraving until recently.

The introduction of the modern art of steel engraving appears to be attributable, in a considerable degree, to the excitement which existed rather more than twenty years since on the subject of the forgery of bank-notes. That subject was investigated in 1818 by a committee of the Society for the Encouragement of Arts, Manufactures, and Commerce, who received several proposals for rendering bank-notes more difficult of imitation; and the very interesting communications made to the committee were published by the Society in 1819, as a supplement to their 'Transactions.' The introduction of superior workmanship in the engraving of plates for bank-notes was one of the measures particularly recommended on this occasion; but, while it was shown that the employment of superior engravers, and the introduction of well-executed vignettes, had been found advantageous by country banks as a means of preventing forgery, it was a measure inapplicable to the small notes then circulated in immense numbers by the Bank of England, which were the notes most extensively forged. 'It is in evidence,' observe the committee, 'that the average number of copies taken from each copper plate does not much exceed six thousand;* hence, if the expense

* Mr. Warren stated that about seven thousand copies were taken by the Bank of England before the copper plates used by them required to be retouched; but other witnesses mentioned from five to six thousand as the number of impressions which each plate would afford. It is almost needless to observe that the great difference between the early and late impressions rendered it more difficult for an inexperienced person to detect a forgery than it would have been if no perceptible difference existed between the genuine notes.

of engraving were greatly enhanced, the profit arising from the issue of one-pound notes would entirely cease.' 'If,' it proceeds, 'the daily issue of small notes from the Bank of England amount to thirty thousand,—and, from the evidence produced, there is reason to believe that it exceeds rather than falls short of this number,*—there is a daily consumption of five plates, or fifteen hundred in the year; and there might perhaps be some difficulty in finding a sufficient number of superior artists to produce the required quantity of plates.' The substitution of steel for copper is then adverted to as a measure likely to obviate these difficulties, because, owing to its greater hardness, it was believed that a steel plate might be made to afford twenty, or perhaps thirty times the number of impressions that copper would do; so that, while perfect similarity might be insured in a much larger number of notes, a far greater expense might be advantageously incurred in the engraving of each plate. Mr. J. T. Barber Beaumont, in his communication to the committee, after alluding to the ultimate economy of the plan, notwithstanding the increased cost of the proposed steel plates with well-executed vignettes, as compared with the badly engraved copper-plates then used, which contained nothing worthy of the name of a work of art, observes:—'A further effect of this system in preventing forgeries would be found in all the notes of one kind for a long period of years being taken from one plate, whence a person having a genuine note might compare it with the minutiæ of another suspected to be forged; and as it would be impossible even for the artist himself who had engraven an original plate to follow, in a copy, the length, sweep, depth, and number of the strokes in his original, a detection would be easily made, even by those who knew nothing of the arts.' The conditions of this argument, although unattainable to the extent here intimated by the use of soft steel plates, might be perfectly accomplished by the transferring process hereafter described. Mr. Warren exhibited to the committee a specimen of engraving upon soft steel, which fully proved its practicability; and it was also explained by several witnesses that a block or plate of steel might be softened so as to render it easy to cut, and subsequently hardened to enable it the better to resist wear in printing. Something of this kind indeed had been practised in North America. American bank-notes were shown to the committee, containing ornamental borders, partly of machine-work, which were pronounced to be 'scarcely, if at all, imitable by the common process of engraving.' Mr. Clymer, a gentleman who had been engaged in the production of bank-notes in the United States, stated that these borders were engraved upon thick plates of soft steel, and proceeded to describe the process as follows:—'After the pattern has been completed, the plates are hardened. These plates are then employed to impress a reverse on rollers of very soft cast steel, by repeatedly passing the plate between the rollers. The rollers are then hardened, and from these the impression is transferred to plates of copper, on which the writing and vignette are afterwards engraved in the usual way.' The Report of the committee was accompanied by impressions from two steel plates, engraved by Mr. Williamson. They consist of engine-turned patterns; and, although not remarkably delicate, are very well executed.

The resumption of cash payments by the Bank of England, and the subsequent discontinuance of small notes, rendered the proposed improvements less imperatively necessary; yet steel plates have been, since the date of this Report, rapidly extending in use, both for bank-notes and other matters in which writing and ornamental machine-work form the principal feature, and for engravings of higher character. The principal improvements by which this very important change has been effected, are recorded in the published 'Transactions' of the Society of Arts; and that association has done much to encourage the progress of steel engraving. In noticing some of the chief improvements in question, a distinction will be made between the process of engraving on decarbonised plates which are intended for subsequent hardening, and that of engraving upon such plates of soft steel as are printed from without hardening.

The former of these is the process introduced into this country, in connection with the transferring operation above alluded to, by Messrs. Perkins and Fairman, from the United States. Their method of producing engraved steel plates was established in England soon after the date of the Society's Report. Mr. Charles Heath, the eminent English engraver, being associated with the American artists; and it is fully described in a communication from the three partners to the thirty-eighth volume of the 'Transactions' of the Society of Arts, whence it was transferred to several other works. The engraving is executed upon a plate or block of cast-steel, which, to prevent the risk of warping, is of considerable thickness. About five-eighths of an inch is stated to be the average thickness of the plates used by Mr. Perkins. The surfaces of this plate are decarbonised by placing it in a close cast-iron box, with a sufficient quantity of iron-filings to cover the plate to the thickness of at least half an inch, and exposing it, while thus enclosed, to a white heat, until the steel is decarbonised, or converted into very pure soft iron, to a depth equal to about three times the depth of the incisions to be made in executing the intended engraving. The box is then cooled very slowly, being covered up with fine cinders to prevent the access of air. In performing this process, it is said that the plates are least likely to warp when in a vertical position; and that it is advisable to decarbonise each side of the plate equally. On the plate thus softened the engraving is effected with facility; and, when it is completed, the hardness of the surface is restored by exposing the plate for some hours to a red heat, the surface being thickly covered with animal charcoal, formed of burnt leather or bones, and the whole being, as before, enclosed in a cast-iron box. The plate is afterwards cooled in water; but it is not allowed to remain in the water till quite cold, but taken out so soon as it is cooled to the tempering heat, which is ascertained by careful attention to the sound emitted. The plate should be taken out when at the heat required for tempering to a straw-colour, and afterwards lowered by holding it over a fire until tallow, smeared on its surface, is decomposed by the heat, so that smoke arises from it. It is then again put into water till the sound emitted is rather weaker than before. These operations are repeated until the plate has been three times lowered, or softened, over the fire, and three times partially hardened by cooling, after which it is finally cooled in water. It is then cleaned off, and again tempered over a fire to a brown or such other colour as may be needed. From this hardened plate the engraving is transferred to a softened steel roller, of small diameter, which is pressed against the plate with such force that its surface becomes embossed with a perfect transfer or impression of the engraved device. The roller, or cylinder, is then hardened in a similar manner to the original plate, and is afterwards made to transfer the devices from its surface to any required number of softened or decarbonised plates, which are then hardened for printing from. This beautiful process is not only applicable to transferring engravings from one plate to another; but, in cases where one ornament has to be repeated several times on one plate, the device may, by being once engraved, be impressed as often as necessary upon different parts of the same plate. The power of multiplication is, for all practical purposes, unlimited. An instance of its utility, which will be familiar to every one, is afforded by the adhesive stamps used as postage labels since the adoption of the penny postage: the device of the queen's head has been only once *engraved*, although, by the application of this process, it has already been multiplied about *six thousand* times, each impression or transfer upon steel being equal to the original engraving, and capable of yielding an immense number of prints or impressions on paper. The number of impressions yielded by each hardened steel plate depends much upon the character of the engraving, and in some degree upon the success of the recarbonising or case-hardening operations, but it may be stated generally to range between fifty and a hundred thousand. In some cases the latter number has been greatly exceeded; and, in the paper from which the above account of the art is chiefly derived, an instance is mentioned in which *five hundred thousand* copies were printed from a plate which was strongly engraved. During the twenty years in which this process, which was formerly termed *siderography*, has been practised in this country, several minor improvements have been effected; but we believe that the above account remains substantially correct. The perfection which has been attained is almost beyond conception; the finest writing, and the most minute and intricate patterns, being transferred from plate to plate with such precision that the keenest scrutiny cannot detect a

* 'Mr. Ramshaw stated, that he has heard from good authority, that the daily issue of Bank of England notes of all descriptions is about *sixty thousand*, in producing which about fifty-three presses are employed.' (*Minutes of Evidence*, p. 61 of *Report*.)

difference between the original and the transfer. Even the early specimens which accompany the paper above referred to, fully justify this remark. The plan has been much used for country bank-notes and similar purposes, and has been occasionally resorted to for engravings of pictorial character, for which however the kind of steel engraving yet to be noticed is most commonly employed.

The application of steel engraving to matters of fine art is, in a great measure, due to the late Mr. Charles Warren. In 1823 that gentleman made a communication upon the subject to the Society of Arts, who voted him their large gold medal for his improvements in the art; a prize which he did not live to receive. Owing to his death before the rewards of that year were bestowed, the Society were deprived of a full communication which was to have been made by him, and consequently the details published in the forty-first volume of their 'Transactions' are less perfect than might be desired. It is there stated that Warren had in his youth been engaged in engraving for calico-printers and gunsmiths, by which employment he was led to devote some attention to steel engraving. Mr. Gill, one of the chairmen of the committee of mechanics in the Society of Arts, and subsequently editor of the 'Technical Repository,' suggested to him the method practised at Birmingham in ornamenting snuffers and other articles of cast steel, by decarbonising the surface to render the execution of the pattern easy, and subsequently case-hardening the article; a process very similar to that described as forming part of the art of siderography. Serious difficulties impeded the application of this plan to plates suitable for engraving; because, if they were made thin, like ordinary copper plates, they were liable to warp in hardening; while if thick enough to avoid this danger, it was impossible to beat up the surface from the back in the usual way, when it was necessary to make any correction or erasure. When alterations were required in a thick plate, it was found necessary either to grind down the whole surface of the plate, thereby losing the whole of the work instead of merely the defective part, or to force up the surface in the faulty place by inserting a screw in a hole drilled at the back. These inconveniences led Warren to try the durability of steel plates when printed without hardening. It was ascertained that such plates would yield a sufficient number of impressions for ordinary purposes; while, by dispensing with the hardening process, they might be made thin enough to allow of beating up without inconvenience. Prints were exhibited to the Society from two soft steel plates engraved by Warren, containing very delicate work in landscape and figures, of which four and five thousand impressions had been taken respectively, and yet between one of the first and one of the last copies there was no perceptible difference. Some other of the specimens produced, portraits for the 'Evangelical Magazine,' had printed twenty-five thousand copies, and yet remained in good order; and in another case the engraver's proofs were not taken till twenty thousand copies had been printed.

Warren's original mode of decarbonising steel plates was similar to that adopted by Perkins, excepting that the box was filled with a mixture of iron turnings and pounded oyster-shells, instead of simply iron filings, and that several plates were laid in the same box, alternating with layers of the decarbonising mixture. Mr. Hughes, a copper-plate maker, improved upon this process by substituting a box or case of refractory clay for the cast-iron box; by which means he was enabled to apply a degree of heat that would have melted the iron, and thereby to soften the plates more completely. Each plate required two or more 'cementations' to soften it to the required degree; and Warren rectified any accidental warping by striking the plate with a hammer between these operations. Hughes found it better to perform this operation with a mallet, and to apply that with as little force as possible.

It is recommended that the surface of a steel plate should not be polished very highly, and that in applying etching ground to it, the plate should not be heated quite so much as is usual with copper. In either case the ground is apt to granulate or *honey-comb* upon the plate, by contraction in cooling. The ground should also be laid rather thicker than upon copper. Warren tried several different menstruums, but that which he most approved consisted of half an ounce of crystallized nitrate of copper, dissolved in a pint and a half of distilled water, with a few drops of nitric acid added to the solution. He recommended that it should be laid on the plate in a layer not exceeding one-sixth of an inch deep, to enable the operator to see the action distinctly; and that the plate should be constantly swept with a camel hair brush, to remove the precipitated copper, which, if left in the lines, would render them rugged. When this kind of menstruum is employed, it is necessary to lay on the Brunswick black or other varnish used for covering such parts as are sufficiently etched, or *bitten in*, very smoothly; because anything like a ridge retains the deposited copper, and where it remains the ground is liable to give way.

In 1824 the Society of Arts gave their large gold medal to Mr. Edmund Turrell for his improved menstruum for etching on steel, by which the inconvenience of sweeping away the copper was avoided. It consists of four parts *by measure*, of the strongest pyroligneous (acetic) acid, and one part of alcohol, or highly rectified spirits of wine. These should be mixed, and gently agitated for about half a minute, after which one part of pure nitric acid should be added. The rapidity of the process of etching may be increased or diminished by exceeding or reducing the proportion of nitric acid in the mixture. This menstruum should not be mixed long before it is wanted, as it deteriorates by keeping many hours. After etching, the plate should be washed with a mixture of one alcohol to four water. Turrell recommends that Egyptian asphaltum dissolved in essential oil of turpentine be used for stopping out, as the common Brunswick black of the shops is affected by alcohol. In 1826 the Society rewarded Mr. Humphrys for a menstruum for soft steel, consisting of a quarter of an ounce of corrosive sublimate and the like quantity of alum, both powdered, dissolved in half a pint of hot water, but cooled before it is applied to the plate. This menstruum should be kept constantly stirred with a camel-hair brush while acting; and, as it soon becomes turbid, it should, in etching fine work, be thrown away and renewed after acting a short time. This menstruum has received the sanction of several eminent engravers. Some engravers, we believe, use two different kinds of menstrua for etching on steel: one for biting-in the more delicate tints, and another for etching the parts that require considerable depth.

Allusion has been made to the difficulty experienced by the early steel engravers in consequence of the hardness of the metal, which rendered it very inconvenient to cut, and constantly broke the points of their tools. In Gill's 'Technical Repository,' vol. iii., p. 356, it is stated that Warren found the best gravers for the purpose to be those made by Mr. Stodart, of his alloy of cast-steel and rhodium. In the eighth volume of the same work, p. 296, Turrell recommends a process of cold hammer-hardening for gravers for steel plates.

In the application of steel engraving to matters of fine art, the accomplishment of mezzotinting upon steel plates is one of the most important points, as the wear of copper plates engraved in this manner is very rapid. The advantages of steel plates, and the peculiarities of the mezzotinting process as applied to them, are alluded to in a previous volume. [MEZZOTINTO, vol. xv., p. 169.] According to Gill (*Tech. Rep.*, vol. iii., p. 287), mezzotinto engraving was executed upon steel as early as 1820, by Messrs. Perkins, Fairman, and Heath. In 1822 Mr. Thomas Lupton was rewarded by the Society of Arts for an engraving in this manner on soft steel, and he then exhibited good impressions from a plate which had yielded fifteen hundred impressions; and in 1824, in the forty-second volume of the Society's 'Transactions,' an interesting paper was published upon the invention, progress, and advantages of engraving in mezzotinto upon steel, by Mr. Charles Turner. That artist states that the subject was suggested to him as early as 1812, and that, finding steel, as then prepared, too hard, he tried brass, but without success. In January, 1820, Say executed a mezzotint engraving on one of Perkins's plates, and before the date of Mr. Turner's communication, this new branch of art had been practised also by Ward, Reynolds, Lupton, &c. 'In engravings in mezzotinto on steel,' he observes, 'the tones are far better defined than those obtainable upon copper. From the superior density of the metal, the clearness of the lighter tints is carried to much greater perfection; and, from the same cause, the darks have also a decided preference, being distinguished by their superior richness.'

To preserve steel plates from injury by rust, it has been recommended to smear their surface with sheep's suet, rubbed on while the plate is warm. Some use virgin wax for the same purpose; heating the plate to such a degree

that a cake of wax, when gently rubbed over it, leaves a thin but perfect film upon it.

The cost of engraving upon steel is considerably greater than that of engraving upon copper:* yet, as steel plates afford so many more impressions than copper, they enable the publisher, by calculating his returns upon a large instead of a small number, to issue works of art at so low a price as may ensure their very wide circulation. This may be illustrated by referring to the series of maps published by the Society for the Diffusion of Useful Knowledge. The cost of production in this and in every similar case, may be divided into two parts: the cost of authorship, engraving, &c., which is a fixed sum, independent of the number of impressions required; and the cost of paper and printing, which is a fixed sum *for each impression*, whether the edition be large or small. The latter part of the cost forms therefore an unalterable sum for each copy; but the former must be incurred alike for twenty or two thousand copies, and may be met either by a large sum added to the price of each copy in a small edition, or by a small sum charged upon each copy in a large edition. Had the Society calculated upon a sale of only two thousand copies of their maps (which was the utmost number that experience would have entitled them to hope for), the estimate would have stood somewhat as follows:—

Expenses incurred for each plate, independent of the number of copies required—

Assumed cost of authorship . .	£21	0	0
Assumed cost of engraving (*on copper*)	21	0	0
	£45	0	0

Expenses dependent upon the number of copies printed—

Paper for two thousand copies . .	£5	0	0
Printing two thousand copies . .	8	0	0
	£13	0	0

Dividing these sums by two thousand, it will be seen that the cost of paper and printing for each copy is about 1·56*d.*, and the proportion of the cost of the plate chargeable upon each copy is 5·40*d.*, making the total expense of each copy 6·96*d.*, or very little under 7*d.* Allowing therefore the usual addition of one-third for the profits of the retailers, the price to the public could not have been less than 10½*d.* Supposing the number sold to be four thousand, the total cost per copy would have been reduced to 4·26*d.*, because the expense of the plate, being distributed over double the number of copies, would have been but 2·70*d.* for each. But this number of impressions would have worn out a copper plate, even supposing, which would be an extreme case, that so large a number could have been printed without too great a deterioration of the engraving. The Society however determined upon going to the greater expense of steel plates, which the engraver undertakes shall be capable of furnishing twenty thousand copies; and they calculated their returns upon a sale of eight thousand copies. The estimate of first cost therefore stands nearly as follows:—

Assumed cost of authorship . .	£21	0	0
Cost of engraving (*on steel*) at least .	35	0	0
	£56	0	0

but by dispersing this larger sum over a number of eight thousand copies, the proportion chargeable to each is reduced to 1·68*d.*, which, with 1·56*d.* for paper and printing, makes the total cost of each copy 3·24*d.*, or rather less than 3¼*d.* Thus the maps were profitably published, even with the addition of a wrapper, at 6*d.* each. The result has fully justified this measure, as, of some of the earlier numbers, upwards of twenty thousand copies have been sold, a number which the best engraved plates have yielded without perceptible injury. The sum mentioned as the cost of engraving is about the least which has been paid; but assuming it to be the cost, the proportion of first cost chargeable on each copy of the maps which have been most extensively circulated is only ·672*d.*, which, with the price of paper and printing, makes the cost per copy 2·232*d.*, or little more than 2¼*d.* If copper plates had been used, notwithstanding the smaller cost of engraving, it would probably have been impossible to reduce the cost per copy below 4½*d.*, or from that to 5*d.*; because, if twenty thousand impressions had been required, five plates must have been engraved, at an expense of at least 120*l.*, instead of one at the expense of 35*l.*

In the production of illustrated books, the advantages of steel engraving are strikingly observable, since, by acting upon the principle above stated, many works have been published of late years which could not have been produced with copper-plate engravings, because the number of impressions being so limited, the price of each copy must have been such as to preclude the possibility of a remunerative circulation. To take an instance, by no means the most recent, it may be mentioned that the beautifully illustrated edition of Rogers's 'Italy,' issued in 1830, was published profitably at the low rate of twenty-eight shillings, although seven thousand pounds had been expended in its production; so that, merely deducting one-fourth for the regular allowance to booksellers, at least seven thousand copies must have been sold to return the cost of production. The volume of poems by the same author, which was published soon afterwards, although issued at the same price, was still more expensive in its production. (*Printing Machine*, vol. i., p. 13.) In periodical publications of large circulation the use of copper plates was attended with great expense and inconvenience. The 'Evangelical Magazine,' for example, in order to supply portraits for an edition of more than twenty thousand copies, was compelled to use four distinct plates, each of which, in many cases, had to be repeatedly retouched by the engraver to make it yield the necessary number. In January, 1823, steel was first adopted for this work; and, one plate being sufficient, much more elaborate engravings were used. Of the portraits engraved on steel for this and another work of similar character, it is not unusual to take the full number now required, about sixteen thousand copies, without any repair being done to the plate.

The recently invented art of multiplying engraved copper-plates by voltaic electricity may possibly have some effect upon the future use of steel engraving; since it affords the means of obtaining an indefinite number of impressions without deteriorating the original plate. The inferior density of electrotype plates, which would, it is supposed, occasion their rapid wear, has been urged as an objection to their use for printing long numbers; but the writer has been assured that ten thousand impressions have been obtained from one electrotype plate, the engraving of which was strong and deep.

STEELE, SIR RICHARD, was born at Dublin in 1671. His father, who was private secretary to James, first duke of Ormond, sent his son to be educated at the Charterhouse in London; thence Steele was removed to Merton College, Oxford, and admitted a postmaster on that foundation in 1691. He afterwards was an ensign in the Guards, and in 1702 attracted the notice of the public as an author by the publication of 'The Funeral, or Grief à-la-Mode,' a comedy, successfully acted in that year. Two more comedies, 'The Tender Husband,' acted in 1703, and 'The Lying Lover,' 1704, followed this first attempt. In 1709 he commenced 'The Tatler,' the first, in our literature, of a series of periodical works in the form of short essays. He was soon after made one of the commissioners of the Stamp-office. In 1711 he began, in conjunction with Addison, 'The Spectator,' and in 1713 'The Guardian.' In this year he was dismissed from his situation in the Stamp-office, and was elected member for Stockbridge in Hampshire. In March of this year he was expelled the House for writing two pamphlets, 'The Englishman' and 'The Crisis,' on the succession to the crown of England, alleged to contain treasonable matter relative to the reigning family: he was supported on this occasion by Addison, and other distinguished members of parliament.

After the accession of George I., in 1715, Steele was made surveyor of the royal stables at Hampton Court, and was knighted on the presentation of an address. The same year he was chosen member for Boroughbridge in Yorkshire, and appointed one of the commissioners of forfeited estates in Scotland. He continued to write articles relative to the political events of the time, and in the latter years of his life appears to have suffered much from poverty, caused partly by a habit of speculating in new projects. He sustained a considerable loss—nearly 10,000*l.* by his own account (see his letter to the duke of Newcastle, *Epis. Corr.*, 469)—by the revocation, in 1719, of the patent by which he

* In the infancy of the art it was usual to charge engraving upon steel double the price demanded for the same work upon copper; and even now the comparative expense of engraving upon steel and copper is, we believe, in most cases, about as three to two.

was constituted governor of the royal company of comedians. In 1722 his comedy of 'The Conscious Lovers' was acted. Some time before his death he retired into Wales, to his seat at Llangunnor, near Caermarthen, where he died September 1, 1729. He had been twice married, first, to a lady of Barbadoes, secondly, to Elizabeth, the daughter of Jonathan Scurlock of Llangunnor, Esq., by whom he had a daughter, married in 1732 to the Hon. John Trevor, afterwards Baron Trevor of Bromham.

Steele has the merit of having originated a kind of periodical literature not before known in this country. Of the value of the series of works commencing with 'The Tatler,' of which, in conjunction with Addison, he was the author, it is needless here to speak. They are remarkable for a style combining with the ease of familiar conversation grammatical correctness and purity of language, for the invention and judgment shown in the choice, and the versatility in the treatment, of the subject, and, above all, for the refined and Horatian satire which, expressing itself in a tone of playful irony, and by means of allegory and representation of character never directly personal, formed the taste and reformed the manners of the generation by whom the perusal of these writings was regarded as a passing amusement.

There is a full biography of Steele in Chalmers's 'Biographical Dictionary.' Authority for the principal facts there stated may be found in his Epistolary Correspondence, published from the originals in the British Museum, and illustrated with literary anecdotes, by John Nichols, 2 vols., 1788; who also edited, in 1791, 'The Theatre, with the Anti-Theatre,' Steele's Case with the Lord Chamberlain, with other of his tracts; and in 1790, 'The Town Talk,' 'Fish Pool,' 'Plebeian,' 'Old Whig,' 'Spinster,' &c., 8vo. His plays were published in 12mo. by Tonson, 1755.

STEELYARD, in mechanics, a kind of balance or weighing-machine, consisting of a lever of unequal arms. The most common kind of steelyard, which is often called the Roman balance, is a lever of the first order, and is used by suspending the article to be weighed from the end of the shorter arm, and sliding a determinate weight along the longer arm, to a greater or less distance from the fulcrum, until the instrument remains in equilibrium in an horizontal position; the weight of the substance attached to the short arm of the lever being indicated by observing the position of the moveable balance-weight with respect to a graduated scale marked upon the long arm of the steelyard. In the common steelyard a hook or hooks are usually suspended from the short arm, to hold the article the weight of which is to be ascertained; but sometimes a scale-plate or dish suspended by chains is added. The moveable weight is commonly attached to a ring, the form of which enables it to rest in notches cut on the upper edge of the steelyard, corresponding with the graduations engraved on its side. A ring or hook is also attached to the fulcrum, so that the instrument may be conveniently hung upon a fixed support, or if small, held in the hand; and a vertical index or pointer, similar to that attached to the beam of common scales, is sometimes added. The fulcrum, and the axis from which the weight is suspended, should, when much nicety is required, be provided with knife edges or bearings resembling those used in other lever-balances. Many steelyards are supplied with a second fulcrum; the two being placed at different distances from the point to which the hook or scale is attached, and having their respective pointers and suspending-hooks on opposite sides of the lever, or rather, when held in the position for use, one above and the other below it, as shown in the cut of an antient Roman steelyard which is inserted at the end of this article. In using a steelyard of this kind, capable of weighing from one to sixty pounds, the fulcrum which is nearest to the middle is used if the article be under fifteen pounds; while, if it exceed that weight, the instrument must be inverted, and suspended from the fulcrum which divides the lever most unequally. Of course when this arrangement is adopted, the shackles, from which the article to be weighed and the moveable weight are suspended, must be so formed as to hang equally well in either position of the lever; and different graduated scales must be used for each. It scarcely need be observed that, while it is a peculiar character of this kind of balance that the weight used is much lighter than the article weighed, it is possible to use it for bodies of less weight, by placing the moveable weight nearer to the fulcrum than the fulcrum is to the axis from which the article hangs. The degrees of sensibility and stability must be regulated in the same way as in an ordinary equal-armed balance. [BALANCE, vol. iii., p. 307.]

Various modifications of the steelyard have been contrived for delicate scientific purposes, or for adapting it to the purpose of weighing very heavy bodies. The improvements made by C. Paul, of Geneva, about forty years since rendered this kind of balance capable of weighing with great nicety. They are fully detailed in the third volume of Tilloch's 'Philosophical Magazine,' in a paper translated from No. xlv. of the 'Journal des Mines;' and also in the second volume of Gregory's 'Mechanics,' under the title 'Steelyard.' M. Paul placed the points of suspension exactly in the same horizontal line as the divisions of the beam; and he balanced the steelyard in such a way that, when unloaded, the beam might remain perfectly horizontal, and the index or cock attached to it perfectly vertical. Hence it became easy to ascertain the accuracy of the steelyard by simply unloading it. Instead of obtaining the power of weighing substances of very different weights by the use of two fulcrums, as above described, he used two different weights, with the same fulcrum and graduated scale; one weight being a multiple of the other; so that, for instance, if the heavier indicated, when placed against the figure 10 on the graduated scale, a weight of ten *pounds*, the smaller, placed in the same position, would indicate ten *ounces*. By using the two weights together, the weight of a very heavy body might be ascertained with great nicety. A steelyard which Paul constructed was capable, it is stated, of indicating as little as *one ten-thousandth part* of the weight with which it was loaded. Another advantage attending the use of two weights of this kind consists in the facility which they afford for testing the accuracy of the balance by transposing the weights. Thus, with a correct steelyard, graduated for avoirdupois weight, the balance will be the same whether the larger or *pound* weight be placed at 1, or the smaller or *ounce* weight at 16. The general adoption of such a contrivance would obviate the principal objection to the use of the steelyard for the ordinary purposes of commerce, the facility which it affords for fraudulent deception. Tilloch gives a representation of one of M. Paul's steelyard balances, contrived for scientific purposes, for which it was proposed to use different sets of weights with the same engraved scale, to indicate the weight of the object under examination according to various systems of weights. In a steelyard contrived by Mr. Patten, of Rhode Island, United States, for purposes for which much delicacy is required, the weight is attached to a sliding-box, which traverses along the beam by means of a screw. The screw passes through the sliding-box, and is secured by bearings at its ends in a position parallel with the beam, and it is turned by a milled head. In a large balance on the principle of the steelyard, known as Payne's weighing-machine, the weight is attached to a long box or case, which slides along the beam, and is supplied with a thumb-screw, the point of which is made to press against the side of the beam in order to secure the slide at any required point. The large weight attached to this sliding-box indicates, by a scale marked on the beam, the larger amounts, as hundreds and quarters; and the smaller, as pounds and ounces, are shown by means of a small weight traversing a scale engraved upon the sliding-box.

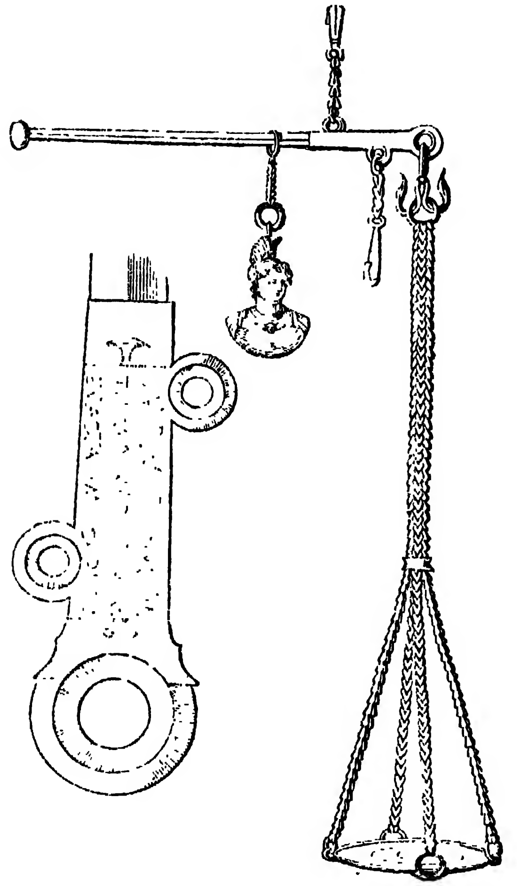
Several ingenious bent-lever balances have been contrived, some of which, from the circumstance of the levers being of unequal arms, resemble the steelyard in principle. These, and the steelyard weighing-machines for ascertaining the weight of loaded carriages, are noticed under WEIGHING-MACHINE.

The balance known as the Danish or Swedish steelyard differs from that above described in having the weight fixed at one extremity of the lever, while the fulcrum itself is moveable.

Though probably not so antient an invention as the equal-armed balance, the steelyard is an instrument of very early origin. Under the name of statera it was well known to the Romans, who often used a weight in the form of a bust. Vitruvius (book x., chap. 8) mentions the statera, and describes the principle on which it acts. Many Roman staterm of brass still exist, some of which are very like the steelyards of the present day. One of these, with a double fulcrum, weight, and scale-plate suspended by chains, is represented in the annexed cut. It appears, by the inscription on the beam, to have been made about the year 77 of our

era. A kind of steelyard is used by the Chinese for weighing very delicate matters, as gems and precious metals. From the manner in which the steelyard is mentioned in a curious tract published in 1578, it would appear that it was not at that time much known in England. The author recommends it for weighing charges for artillery, as being less troublesome than ordinary scales, owing to the use of but one weight, and that of small dimensions, and observes that the instrument was 'altogether used in South Spaine to wey all kinde of marchandise,' and that it was called 'statery.' (Bourne's *Inventions or Devises*, p. 45.)

The portable weighing-machine called the spring or pocket steelyard is noticed under SPRING-BALANCE, vol. XXII., p. 385.



Antient Roman steelyard, found at Pompeii, with part of the beam and inscription on a larger scale.

STEELYARD, MERCHANTS OF THE, a body of aliens who enjoyed various commercial privileges in England from an early period to the middle of the sixteenth century. 'The emperor's men,' mentioned in some ordinances of Ethelred II. (A.D. 978-1016) as trading to England, were the predecessors of the merchants of the Teutonic Gild. In 1220 the merchants of Cologne had a hall or factory in London for the legal possession of which they made an acknowledgment to the king. 'It seems that this Gildhall, by the association of the merchants of other cities with those of Cologne, became in time the general factory and residence of all the German merchants in London, and was the same that was afterwards known by the name of the German Gildhall (*Gildhalla Teutonicorum*)'. (Macpherson, *Annals of Commerce*, i. 383.) In 1235 Henry III. gave them permission to attend fairs in any part of England, and also to buy and sell in London, saving the liberties of the city; and they were exempted from several customs and payments. In the fifteenth century we find the Hanse merchants engrossing the privileges of the above antient incorporation, Cologne being a member of the League, and the whole of the German merchants resident in London probably belonging to one or other of the Hanse towns. At least, after 1475, they had but one factory in London, which was the Steel-yard, or Steel-house, as it was sometimes called, situate a little east of Dowgate, between Thames Street and the river. In 1475 Edward IV. entered into a treaty with the Hanseatic League, by which the privileges of the London factory were placed on a more secure foundation, instead of being granted only for a short period, and being at times curtailed and even occasionally suspended. By way of settling former disputes, it was thought worth while to pay them 10,000*l*., or rather to remit customs' duties on their goods to that amount. The king was to appoint two or more judges to act without the ordinary legal formalities in all civil and criminal cases between the Hanse merchants and English; and similar regulations were to be adopted in reference to English subjects residing at the Hanse towns. The fee simple of the Steelyard was conveyed by this treaty, also the Steelyard at Boston, and a house at Lynn. Under this treaty and their old charters the Hanse merchants of the Steelyard were enabled to monopolise certain branches of trade, in which they were exempted from duties payable by other traders; and by their combination and capital, they were doubtless formidable competitors in other branches of foreign trade; but though the activity of foreigners might be tolerated while native capital was wanting, yet a trade from which English merchants were virtually excluded could not possibly be permanent. Besides exciting popular indignation, the privileges of the Steelyard merchants were politically inconvenient, for when the direct trade with the Netherlands was stopped in 1493, large quantities of Flemish goods were imported from the Hanse towns into the Steelyard. On this occasion the journeymen and apprentices of London attacked the warehouses of the obnoxious Germans.

In 1505 a rival interest was created, by a charter granted to the Company of Merchant Adventurers for trading in woollen cloth to the Netherlands. The merchants of the Steelyard were bound in heavy penalties not to interfere with the trade of this new incorporation, which soon became a powerful rival not only to the German merchants, but to the merchants of the staple. In 1551 various allegations of the Merchant Adventurers, with the counter-statements of the merchants of the Steelyard, were put into the hands of the solicitor-general and the recorder of London, upon whose report the council came to a resolution that the Steelyard merchants had forfeited their privileges, their charters being contrary to the laws of the realm. The council reported that, no particular persons or towns being mentioned in these charters, the corporation had extended their privileges to whomsoever they pleased; that English subjects had not enjoyed reciprocity of privileges in the Hanseatic towns; that their English trade was no longer confined to the Hanse towns; that they had engrossed almost the entire trade carried on by foreigners in the kingdom; lastly, that they had reduced the price of wool, and also of corn by their importations of foreign grain. The articles which they imported, besides grain, are stated to have been cordage and other naval stores, flax and hemp, linen, cloth, and steel. The English Merchant Adventurers flourished on the ruin of the older incorporation, which however continued to linger until 1597, when the emperor Rudolph having ordered the factories of the English Merchant Adventurers in Germany to be shut up, Queen Elizabeth directed the lord mayor of London to close the house occupied by the merchants of the Steelyard. It is said that in 1554 Queen Mary had restored their privileges, and in a year or two afterwards withdrawn them, but the facts are not very clear on this point. [HANSE TOWNS; STAPLE.]

(Strype's *Eccles. Mem.*, iii. 77; Anderson's *Commerce*; Macpherson's *Commerce*.)

STEEN, JAN, one of the most celebrated painters of the Dutch school, was born at Leyden, in the year 1636. His father was a brewer, who, complying with his son's desire to be a painter, put him apprentice to Nicholas Knupfer, a German artist of considerable note, at that time residing at Utrecht. He afterwards studied under Van Goyen, who was so pleased with his agreeable manners, and his talents as a painter, that he gave him his daughter Margaret in marriage. Though Steen soon acquired great reputation, he did not gain sufficient to live with comfort, because he spent much time on his pictures, which he finished with extraordinary care. His father therefore advised him to set up a brewery at Delft, in which he had every prospect of success, but his propensity to an idle, intemperate, and dissolute course of life made him neglect his business, and having incurred debts, he was driven by necessity to his pencil. With the assistance of his relations he set up a

public-house, which was much frequented, but only gave him more opportunity and temptation to indulge in his intemperate way of life. The scenes which he saw here he transferred, often in a state of intoxication, with unrivalled skill to the canvas. None of his able contemporaries surpassed him in the naiveté of his compositions, in the expression and character of his figures, and the skilful distribution of light and shade. 'In spirit, humour, and invention,' says Dr. Waagen, 'Steen excels all other Dutch painters in the same line: to this is added a free, light, easy touch, a great freshness and clearness of colouring, and sometimes a delicacy of execution approaching if not equal to Metzen.' He sometimes attempted historical subjects, such as Moses striking the Rock, but it is in scenes of domestic life, of the higher as well as the lower classes, that he is without an equal. It seems that he also painted portraits. At Lord Spencer's seat at Althorpe there is a fine portrait of Sir Kenelm Digby ascribed to him.

After the death of his wife, by whom he had six children, he married a widow with two children. His business failed, and he was scarcely able to procure sufficient for his subsistence, by the sale and pawning of his pictures, which in his latter years were slightly painted. He died in 1689, leaving his family in the utmost distress. His works, which had not fetched great prices during his life, rose rapidly in value after his death, and are now greatly coveted, and sold at high prices. Several of his finest pictures are in England, in the collections of the Duke of Wellington, Lord Ashburton, Sir Robert Peel, Mr Hope, Mr Beckford, and in the private collection of his late majesty King George IV. His drawings are excessively scarce. He likewise executed a few very spirited etchings, which are also very scarce.

(Houbraken; Pilkington, by Fuseli; Bryan; *Conversations Lexicon*.)

STEENWYK, HENRY, the Elder, a celebrated painter, of the Flemish school, was born at Steenwyk in 1550. He studied under his father, who was well versed in painting, architecture, and perspective; and also under John Fredemann, called De Vries. Like his master, he painted architectural subjects; but excelled him and all his contemporaries in truth, delicacy, transparence, and neatness. His favourite subjects were the interiors of magnificent Gothic churches and convents, and most frequently views by night, when they were illuminated by flambeaux or tapers. He was a consummate master of chiaroscuro, and his lights and shadows are distributed with the greatest judgment. The reflections of his lights are beautiful, and every column, cornice, and other member of the Gothic architecture is represented with the most perfect truth and precision. His pictures are usually enriched with figures by Breughel, Van Tulden, and other distinguished artists. His genuine works are extremely rare, and very highly prized all over Europe. To avoid the troubles of war, he retired to Frankfort, where he died in 1603 or 1604.

STEENWYK, HENRY, the Younger, the son of the preceding, was born in 1585. He followed the style of his father, by whom he was very carefully instructed, and very good judges have thought that he often equalled or even surpassed him. His friend Vandyck, for whom he often painted the architectural and perspective backgrounds of his pictures, induced him to visit England, and introduced him to the court of Charles I., where he met with the encouragement due to his talents, and found employment in this country for several years. He died at London, when still young, but in what year is uncertain. His widow, who had been instructed by her husband, retired to Amsterdam after his death, and practised painting there: her works were greatly esteemed and readily purchased at high prices. The celebrated Peter Neefs, father and son, were among the disciples of the elder Steenwyk. The portrait of the son by Vandyck is engraved in the collection of the portraits of the chief artists of his time.

STEER. [Ox, p. 73.]

STEEVENS, GEORGE, was born at Stepney, in 1736. His father was connected with mercantile pursuits in London, being a director of the East India Company. George Steevens was placed on the foundation at Eton, and became a scholar of King's College, Cambridge, in 1754. His first publication, and a most useful one, was the reprint, in four volumes, octavo, of 'Twenty of the Plays of Shakespeare, being the whole number printed in quarto during his Lifetime,' &c. These plays profess to be literal copies of these rare editions; and in several instances the various readings of other quarto editions are given in the foot-notes. This was an acceptable service to all students of our great poet; and a comparison of many of these plays with the originals enables us to say that the reprints are remarkably faithful. This reprint appeared in 1766. The reputation which Steevens thus acquired led, no doubt, to his association with Johnson in the edition of Shakspere which appeared in 1773 with their joint names. In this edition his assistance was of essential service: for he brought to the task of editing Shakspere qualities in which Johnson was deficient—a more accurate knowledge of early English literature, and greater precision in verbal criticism. Neither his character nor that of the age to which he belonged would have led him to any complete conception of Shakspere's excellence; but what he professed to do, he did satisfactorily. He collated all the copies diligently; he restored many readings which had been tampered with by his editorial predecessors; and he judiciously adhered to the old copies, without attempting to regulate the metre according to the poetical creed of his day. In 1778 the second edition by Johnson and Steevens appeared, in which Malone had rendered some assistance; but Malone, in 1780, published a supplement containing the doubtful plays and the poems. This appeared something like a setting up on his own account; and Steevens, who thought too highly of himself to pay much respect to others, scarcely forgave this. He and Malone at length became rival editors, each working with very laudable diligence in that species of commentary which resulted from their antiquarian knowledge; but each very incapable of throwing any new light upon the poet by a genial admiration and a philosophical estimate of his wonderful performances. Their rivalry, in all probability, gave a new direction to the labours of Steevens. He dedicated himself to the production of another edition, in which he should cast aside the principles which had guided his former labours. He possessed a more decided and more acute mind than Malone; and, with an ill concealed contempt of the plodding diligence of his old fellow-labourer, he went to work to give us a new Shaksperian metre, such as would satisfy the most precise disciple of the ten-syllable school. He proposed, 'instead of a timid and servile adherence to antient copies,' to proceed to the 'expulsion of useless and supernumerary syllables, and an occasional supply of such as might fortuitously have been omitted.' The edition in which this process was perfected was produced in 1793, in fifteen vols.; and such was his commendable anxiety for its correctness, that he often walked from his house at Hampstead to his printer's in London, before day-break, that he might correct the proof-sheets. His experiment was perfectly successful with a public not very critical, who were thus presented with what he called 'a commodious and pleasant text of Shakespeare.' That text remained undisputed in its authority till the publication of Malone's posthumous edition by Boswell in 1821, in which some attempts were made to adhere to the early copies; and no popular edition, conducted upon a different principle, appeared till that of Mr. Knight, in 1838. In his edition of 1793 Steevens made his well-known avowal that he did not reprint the poems of Shakspere, 'because the strongest act of parliament that could be framed would fail to compel readers into their service.' With the exception of his various editions of Shakspere, Steevens did not apply himself to any extensive work. He assisted Nichols in his 'Biographical Anecdotes of Hogarth,' and Isaac Reed in the 'Biographia Dramatica.' His ample means put him above the necessity of literary labour. But his leisure was amply filled up by a system of excitement, which was not calculated to add to his happiness or his reputation. He had the command, which his acuteness and sarcastic power might easily secure, of a newspaper and a review; and the 'St. James's Chronicle' and the 'Critical Review' were made the vehicles of the bitterest attacks upon the literary characters of those to whom in private he was all smiles and courtesy. In some satirical verses, as malignant as his own paragraphs, and rather coarser, we have this character of him (Nichols's *Literary Anecdotes*, viii., 540):—

> 'Mark the old beau's grimaces, his smirk and palaver;
> Mark his crest and fine folds, but beware of his *slaver*.'

Johnson said of him, in answer to Beauclerk's assertion 'He is very malignant,' 'No, Sir, he is not malignant. He is mischievous, if you will. He would do no man an essential injury; he may indeed love to make sport of people

by vexing their vanity.' This, most probably, was the true state of the case. Steevens had no domestic ties, and men were afraid of him. Johnson said, on another occasion, in which there is little doubt he alluded to him, 'Sir, he lives like an outlaw.' His mock praise, his sarcastic politeness, his anonymous ridicule, gratified his sense of power. He had higher abilities and more scholarship than many of the solemn critics who were then busied about our early literature: for then, as it always must be, the small men, who applied themselves to verbal criticism, fancied themselves great (to use Bentley's forcible image) when they were on a giant's shoulders. While Steevens, in his own notes on Shakspere, is making the most profound bows to this man's learning and that man's ingenuity, we can see him winking as it were upon his readers, and whispering, 'what owls!' Amongst other tricks, he set up mock commentators, under the names of Amner and Collins, to perpetrate dirty annotations; and he once signed a bitter attack on Capell, in his own edition, with the name of his timid rival Malone. George Steevens died at Hampstead, in January, 1800; and was buried at Poplar, where his memory is graced by one of Flaxman's monuments.

STE'FANO (called *Fiorentino*) was born at Florence in 1301. Though his most celebrated works, in the church of Ara Coele at Rome, Santo Spirito at Florence, and elsewhere, are no more, he deserves to be mentioned as a disciple of Giotto, and the only one who attempted something beyond the mere imitation of his master, whom, according to Vasari, he excelled in every department of the art. He was Giotto's grandson, by a daughter named Caterina. He was the first who attempted foreshortening, and if he did not completely succeed in this, he certainly made improvements in perspective, and gave new variety of character and life to his heads. No authenticated picture of his remains in Tuscany, 'unless,' says Fuseli, 'we except a Madonna, in the Campo Santo of Pisa, undoubtedly in a greater style than the works of his master, but retouched.'

STE'FANO, TOMMASO DE, supposed to have been the son and pupil of the preceding, was called Giottino, from the resemblance of his works to those of Giotto. A Pietà, at S. Remigi at Florence, and some frescoes of his at Assisi, bear indisputable marks of that style.

STE'FFANI, AGOSTI'NO, an Italian composer of great eminence in the seventeenth century, was born, about the year 1650, at Castello Franco. In his youth he was entered a chorister at St. Mark's, Venice, where a German nobleman pleased with his singing and appearance, obtained his discharge from the church, took him into Bavaria, there bestowed on him a most learned and liberal education, the musical part of it under Ercole Bernabei, and finally, when he had arrived at the proper age, got him ordained, and thenceforward he took the title of *abate*, or abbot, by which he is now commonly known. His ecclesiastical compositions soon became numerous, were much admired, spread his fame, and attracted the notice of Ernest, duke of Brunswick, father to George I. of England, who, though a Protestant, invited the Roman Catholic and clerical musician to Hanover, made him director of his chamber music, and committed to him the management of the opera, then just beginning to raise its head in Germany. But the intrigues of singers at length wearied him of his theatrical and rather incongruous occupation, though not till he had composed several operas, which, translated from Italian into German, were performed at Hamburg from the year 1694 to 1700. These however are forgotten; but his madrigals, motets, and, more especially, his duets, of which Caroline, consort of George II., collected nearly a hundred, are the best known of all his works, and of which it is enough to say, that Handel acknowledged his twelve celebrated duets to have been written in imitation of them.

Steffani was not only a musician but a statesman. He had a considerable share in concerting, with the courts of Vienna and Ratisbon, the scheme for erecting the duchy of Brunswick-Lünenburg into an electorate, for which service the elector assigned him a handsome pension, and Pope Innocent XI. gave him the bishopric of Spiga. In consequence of this he no longer put his name to his compositions, but adopted that of his secretary, Gregorio Piva; and in 1708 relinquished his appointments in Hanover in favour of the, afterwards, great Handel. He died at Frankfort, in the year 1729.

STEIBELT, DANIEL, a celebrated composer for, and performer on, the piano-forte, was born at Berlin, in 1755, where his father was a manufacturer of musical instruments. When a youth, attracting the notice of William III. of Prussia, he was educated at the charge of that monarch, and soon distinguished himself. In his travels he visited Paris and London. In the former city he had the honour to introduce Haydn's *Creation*, and also published many works. In the latter he made a considerable stay, took many pupils, and produced and printed much piano-forte music. He afterwards returned to his native country, and finally settled at St. Petersburg, where he was appointed *maître de chapelle* to the emperor. He there died, in 1823, in distressing circumstances, for he had lived thoughtlessly, to use a very mild epithet. Steibelt may almost be said to have formed a piano-forte school, to which the term *sparkling* may be applied. His best compositions are remarkable for brilliancy, and what we will venture to call picturesque effect, and his execution of them was singularly delicate, animated, and beautiful. He composed also some operas, which were performed in Paris and in St. Petersburg, but these did not survive their author.

STELLA'RIA (from *stella*, a star), the name of a genus of plants belonging to the natural order Caryophylleæ, and the section Alsineæ. The calyx has 5 sepals, the corolla is composed of 5 petals, which are either bifid or bipartite; the stamens are 10 in number; the ovary simple, with indefinite ovules; styles 3, and the fruit a capsule with six valves. There are 67 species of this genus enumerated. Most of them are weeds, which are distributed over all parts of the world. Eight of them are found in Great Britain. In common with the whole order to which they belong, they possess no active properties. Few of them are thought worthy of cultivation, and when planted in gardens they require but little care.

S. Holostea, the greater Stitchwort, is a British species, and is the handsomest plant of the genus. It has a nearly erect stem; lanceolate, acuminated, finely serrated leaves; inversely heart-shaped bifid petals, twice as long as the calyx. It is often planted in gardens as a border flower, for which, on account of its early delicate white flowers, it is well adapted.

S. media is the common chickweed, which is so common and abundant on road-sides and waste places all over Europe. It is characterised by its procumbent stems possessing an alternate line of hairs between each pair of leaves. It has small white flowers, which are open almost all the year. It is frequently eaten as a pot-herb, and small birds are very fond of its seeds.

S. cerastoides, and *scapigera*, the Alpine and many stalked stitchworts, are both of them British plants, and are sometimes cultivated in pots.

STELLA'TÆ, the name of a natural order of plants formed by Ray. The verticillate arrangement of the leaves of the plants of this order gives them a starlike appearance, whence the name. The order is called by Lindley Galiaceæ. [GALIACEÆ.]

STELLENBOSCH. [CAPE OF GOOD HOPE.]

STELLE'RUS, Cuvier's name for a genus of *Herbivorous Cetacea*, *Rytina* of Illiger. [WHALES.]

STE'LLIO, Cuvier's name for a genus of IGUANIANS, under which he arranges the following subgenera:—*Cordylus*, *Stellio*, *Doryphorus*, *Uromastix*, *Agama*, *Trapelus*, *Leiolepis*, *Tropidolepis*, *Leposoma*, Spix (*Tropidosaurus*, Boie), *Calotes*, *Lophyrus*, *Gonocephalus*, *Lyriocephalus*, *Brachylophus*, and *Physignathus*.

Cuvier defines the *Stelliones* to be those Saurians which have, with the general characters of the *Iguanians*, the tail surrounded by rings composed of great scales which are often spiny.

Mr. G. E. Gray places *Stellio* under the family *Agamidæ*, together with the following subgenera, which are included in Cuvier's arrangement:—*Uromastix*, *Agama*, *Trapelus*, *Leiolepis*, *Calotes*, *Lophura*, *Goniocephalus*, *Lyriocephalus*, and *Physignathus*. [AGAMA; REPTILES; SAURIANS.]

STELLIONATE, a word derived from *stellio*, the name of an animal of the lizard kind, mentioned by Pliny (*Hist. Nat.*, l. 3, c. 10), and by Virgil (4 *Geor.*, 243), is a term used in the Roman law to denote all such crimes, in which fraud is an ingredient, as have no special names to distinguish them, and are not defined by any written law. In general, wherever a civil action might be brought on the ground of fraud, there might be a criminal prosecution for

stellionate. The term however is chiefly applied to cases where a person sells, exchanges, or transfers to one, property with respect to which he has already entered into a contract with another. It is also applied to cases of pledging another man's property, substituting base for precious metals, dealing in counterfeit or adulterated goods, and generally to the practice of any species of imposture. The punishment of stellionate was of necessity discretionary. Where the criminal was a person of distinction, the ordinary punishment appears to have been temporary banishment and degradation from his rank; and where he belonged to the lower orders, it seems to have been competent to inflict any punishment short of condemnation to work in the mines. (*Dig.*, 47, tit 20; Hellfeld, *Jurispr. For.*, s. 2067.) The term stellionate is used in the law of Scotland in nearly the same sense as in the Roman law. (Ersk., *Inst.*, 4, tit. 4, s. 79.)

STELLIRIDIANS, M. de Blainville's name for the third order of his *Actinozoaria*, comprehending those radiated animals which are commonly known as *Star-fishes*, or *Sea Stars*, and may be arranged under the great genus ASTERIAS of Linnæus.

The following is M. de Blainville's definition of the order:—

Body generally depressed, wide, and regularly formed, at its circumference, into angles which are more or less sharp, often prolonged into lobes or rays perfectly similar, covered with a skin more or less sustained by calcareous pieces.

Intestinal Canal provided with a single buccal orifice,* unarmed, but surrounded by tentaculiform suckers.

Ovaries radiated and opening at the margin of the mouth.

M. de Blainville remarks that this extremely natural order corresponds almost exactly to the genus *Asterias* of Linnæus: but it has become necessary to add to it the *Encrini*, which the latter author had arranged as species of *Isis*, or *Pennatula*.

The character of the order, according to M. de Blainville, rests—

1. On the nature of the skin, which is more or less flexible, although solidified by very diversiform, calcareous pieces, and which present, at the buccal surface, a sort of vertebral disposition serving for locomotion.

2. On the absence of the anus from the intestinal canal, which last is no more than a stomach more or less lobated at its circumference.†

3. On the constant termination of the ovaries, disposed in rays, at the circumference of the mouth.

As to the form of the body, M. de Blainville admits that it is often very different, although it is always at least regularly polygonal; in fact, he adds, these angles, which are sometimes very obtuse, can be developed so that in the family of the *Ophiuræ* and *Comatulæ* they become true appendages in the form of long rays, sometimes even divided or dichotomized. This disposition has led to the comparison of these animals with stars.

Geographical Distribution.—Very wide. Few or no seas are without some species of the order.

ORGANIZATION.

Digestive System.—The nutritive apparatus of the Stelliridians is very simple; presenting in most of the family a single orifice destitute of teeth in the centre of the lower surface of the body, performing the functions both of the mouth and the anus: but in some presenting a digestive cavity with an orifice for the evacuation of its contents distinct from that by which the food is taken in. In the catalogue of the Physiological series in the museum of the Royal College of Surgeons in London, there are examples of both these modifications.

Illustrative of the first section, consisting of those star-fishes which have the digestive cavity simple, or without distinction of stomach and intestine, receiving and expelling its contents by the same orifice, we find No. 432, a preparation of a star-fish (*Asterias papposa*, Linn.; *Stella dodecactis*, Link; *Asterias helianthoides*, Pennant; *Stellonia papposa*, Agassiz; and *Solaster papposa*, Forbes). It exhibits the central orifice of the digestive cavity, and a portion of the integument has been reflected on the opposite side of the body, to show the numerous cæca continued from the digestive cavity. No. 433 presents a vertical section of the same species, showing the interior of the same cavity. In No. 434 the integument has been removed from the whole of the anterior part of the body of an *Asterias rubens*, Linn. (*Asterias glacialis* and *Asterias clathrata*, Penn.; *Stellonia rubens*, Ag.; *Uraster rubens* of the same, Forbes), showing the membranous digestive cavity, containing some small bivalves. No. 435 is a specimen of *Asterias discoidea*, Lam., from which two rays have been removed, showing the singular and beautifully ramified form of the digestive cavity. The membranous pouches appear to be given off in two series, are sacculated, and strung, as it were, upon a mesentery.

The second modification is shown in No. 435 A, which presents the body of a star-fish (*Alecto glacialis*, Leach). Here the alimentary canal is continued in a spiral direction from the central orifice or mouth, and terminates by a second direct orifice or anus, situated at the extremity of a fleshy tube, which projects forwards by the side of the mouth.

M. de Blainville states that the liver is apparent and rather considerable in the star-fishes; it occupies the circumference of the stomach, forming bunches or *racemi* (des espèces de grappes), which are prolonged more or less into the cavity of the appendages when there are any; at least, he observes, such is the opinion of Cuvier, who is followed by Spix and Meckel. Delle Chiaje, on the contrary, regards these organs as a kind of stomachal cæca (and such an opinion seems to be strengthened by the preparations above noticed), and thinks that the liver is an irregular organ, situated on the upper part or dome of the stomach, of which no other author, according to M. de Blainville, makes mention, and which he himself had not observed. This organ is a racemose little bag of a yellowish-green or yellow colour, and its contents present a similarity to bile both to the sight and taste.

Food.—The very dilatable mouth and gullet of the star-fishes is admirably adapted for securing the testaceous mollusks and other animal substances on which the family feed. When the prey is apparently disproportioned to the parts into which it is to be conveyed, the œsophagus or gullet, together with part of the stomach itself, can be protruded and everted so as to draw the desired food into the cavity by the application of the everted surface to it. Thus the shell-fish is swallowed whole, and specimens still living have been taken from the cavity. At other times the juices of the prey are sucked out, and the exhausted bivalve is left dead with its shell gaping. Not that the old supposition that the star-fish succeeded, in this last mode of feeding, by inserting a ray or finger into the gaping shell, and if it found the bivalve too strong for it, got rid of the difficulty and the ray at once, conscious of its power of reproducing another, seems to be at all founded in fact. Star-fishes have been detected in the act of sucking the juices of conchifera through perforations, and also with their mouths applied to the edges of the valves. From the apparently paralyzed state of the bivalves found in such situations, it has been conjectured that the star-fish introduces some deleterious secretion within the valves, and thus leaves the mollusk torpid and deprived of the power of closing its valves against the attacks of its destroyer. Star-fishes are considered, and not without reason, as great enemies to oyster-beds. [ASTERIAS, vol. ii., p. 515.] But it is not on living prey alone that the star-fishes feed. They seem to assist materially in cleansing the sea from dead and decomposing animal matter. A human tooth has been found in the stomach of a star-fish.

Respiratory System.—Although there does not appear to be any special organ for respiration in the Stelliridians, the oxygenization of the circulating fluid is extensively provided for by the exposure of the peritoneal cavity, and all the viscera, to the sea-water, which is freely admitted through membranous pipes, which have thence obtained the name of respiratory tubes. 'These,' says Dr. Sharpey, 'communicate at their base with the interior of the body, and are perforated at the summit by an orifice which can be very accurately closed. Most of them are placed in groups or patches, and opposite each group the fibrous membrane, forming the wall of the body, presents on its inside a shallow pit perforated with holes, through which the tubes communicate with the internal cavity. The tubes are formed externally of the superficial layer of the skin, and are lined in the inside by a prolongation of the peritoneal membrane. This membrane lines the parietes of the body, and is reflected over the contained parts; at least it

* *Comatula* (*Alecto*, Leach) is an exception.
† But note the exception above alluded to.

covers the stomach and cæca, and probably also the ovaries and vesicles of the feet; opposite the perforated pits it sends prolongations through the holes into the tubes, as may be easily seen on stripping off a portion of it. There can be no doubt that sea-water enters the peritoneal cavity. The animal slowly distends itself with that fluid, and again, but at no stated interval, gives out a portion of it. This is obvious from the fact that the same animal may be seen distended at one time and flaccid at another. Naturalists are generally of opinion that the water enters and issues by the respiratory tubes, and indeed no other orifices have been discovered; we must however freely own that we have never been able actually to observe its passage through these tubes. The peritoneal membrane seems to be the principal seat of respiration; spread over the viscera and the parietes of their containing cavity, and lining the respiratory tubes, it presents a great extent of surface continually in contact with the surrounding medium; and we have found that a beautiful provision exists for maintaining currents of water along the membrane, and thus effecting that constant renovation of the fluid in contact with its surface, which is required in the respiratory process. These currents are produced by means of cilia. Ciliary currents take place also on the external surface of the body, which probably partakes in the process of respiration; we have moreover observed them within the tubular feet, and on the internal surface of the stomach and cæca. In this last situation they are probably subservient to digestion.' (*Cyclopædia of Anatomy and Physiology.*)

Circulating System.—Tiedemann and Delle Chiaje are the authorities from whom a knowledge of the circulating system of the Stelliridians is principally derived: but this part of the organization of these animals is so obscure, that we need not be surprised at the difference which exists in the views of those observers. Thus, the true sanguiferous system is, according to Tiedemann, restricted in a great measure to the alimentary organs and ovaries, and he consequently supposes that the ducts which convey the fluid supplied to the feet, afford nutrition to other parts of the body. In other words, he recognises two distinct systems of nutrient vessels; one a true sanguiferous system, consisting of vessels which carry blood, and the other a set of vessels (those of the feet) conveying a nutritious fluid secreted from the blood.

Delle Chiaje contends that the two orders of vessels above alluded to intercommunicate, and so form but one system.

Dr. Sharpey is disposed to conclude, from his own observations, that the vessels of the feet form a system apart from the blood-vessels, as Tiedemann maintained; but he observes that there is considerable reason to doubt whether, as that author supposes, they serve as the nutritious vessels of the parts in which they run; for, according to Tiedemann's description, it does not appear that they ramify in the tissues. Moreover, Dr. Sharpey adds, their contained liquid does not present the usual characters of blood, or of a fluid adapted to nourish the textures. He admits it to be true that there are floating particles suspended in it, but he states that the clear fluid, when filtered, yields no trace of animal matter, but agrees almost entirely in composition with sea-water. Such, at least, was the result of Dr. Sharpey's examination of it in the *Asterias;* and he proceeds to give an account of the proper sanguiferous system, following Tiedemann as his leading authority, but, at the same time, stating the more material points in which Chiaje differs from him, thus—

'In *Asterias,* a delicate vessel runs along the upper surface of each of the cæca. There are of course ten such vessels in *Asterias aurantiaca* (from which the description is taken), corresponding in number with the cæca. They commence near the extremity of the rays, and, receiving branches from the branches and lobes of the cæca, proceed to the central part of the animal, where they terminate in a circular vessel which runs round the upper part of the body on the internal surface. The circular vessel also receives ten branches from the ovaries, and five from the stomach, which, before joining it, unite into two. The vessels described seem to constitute the venous system, and Tiedemann further supposes that the cæcal and gastric veins convey the chyle or nutritious part of the food from the alimentary organs. The circular vein opens into a vertical canal, which descends along the prominent angle between the two rays, inclosed in the same membranous sheath with the sand canal, and terminates in an inferior circular vessel. The descending canal is dilated in the middle; its comparatively thick, brown-coloured parietes are smooth externally, but reticulated on the inside and composed of interlaced fibres, which Tiedemann found to possess muscular irritability. He accordingly considers this canal as the heart. The inferior circular vessel (which must not be confounded with the circular canal connected with the feet) surrounds the mouth on the outside or inferior surface; it sends out five branches which pass into the interior of the body, and are distributed to the stomach, cæca, and ovaries. Tiedemann regards these branches, with the circular vessel from which they proceed, as arteries, and he thinks it probable that their minute ramifications open into the radicles of the veins, though from their delicacy he has not been able to ascertain the fact by injection. Tiedemann's view of the function of the respective vessels is derived solely from a consideration of their anatomical disposition, and while in the same way it may be inferred that the blood circulates in a direction conformable with this view, it must nevertheless be kept in mind that no direct physiological proof of such a course of the blood has been yet obtained. Besides the vessels described, Tiedemann found yet another circular vessel surrounding the mouth on the under surface, and placed more superficially than the last-mentioned; it is of an orange colour, and sends a branch along each of the rays in the groove which is on the middle of their inferior surface. He could trace no connection between this vessel or its branches and the rest of the vascular system, and he professes himself at a loss to conjecture what may be its function.'

'According to Delle Chiaje, the circular vessel into which the canals of the feet open receives also the veins from the upper surface of the cæca and stomach. The same vessel, which he names the venous sinus, gives out:—1, twenty short *dental* arteries; 2, the *mesaraics* to the under surface of the cæca; 3, five *vertebral* arteries which open into the vesicles of the feet; 4, the *radial* to the under part of each ray; 5, the *dorsal* arteries to the upper part of the ray, which extend their ramifications to the external surface of the body.' (*Cyclopædia of Anatomy and Physiology.*)

Nervous System and Senses.—Professor Owen, in his preface to the third volume of the *Descriptive and Illustrated Catalogue of the Physiological Series of Comparative Anatomy contained in the Museum of the Royal College of Surgeons in London,* remarks that when the nervous system begins to be distinctly eliminated in the form of fibres, it is accompanied by a distinct development of the muscular system; and the digestive canal is provided with a proper contractile tunic, and floats freely in an abdominal cavity. He observes that the nervous fibres in the classes of animals in which they are first discernible proceed from a ganglion or ganglions in the neighbourhood of the mouth, and extend in a radiated or longitudinal direction according to the form of the body, but are not afterwards brought into communication by ganglionic masses.

'The Echinoderms, as the Star-fish and Sea-Urchins,' writes the Professor, 'first present these conditions of the nervous, muscular, and digestive systems. A very gradual transition from the radiated to the elongated form is traceable from this class through the *Holothuriæ* and *Sipunculi* to the cavitary *Entozoa* or *Cœlelmintha* (intestinal worms having an abdominal cavity), and thence to the *Epizoa* and *Rotifera,* which make a near approach to the annulose division of the animal kingdom; but at the same time do not possess that structure of the nervous system which is its true characteristic. The four classes of animals, thus distinguished by a common character of the nervous system from the *Acrita* on the one hand, and the *Articulata* on the other, constitute a second division of the animal kingdom, which may be termed *Protoneura.*'

The preparation No. 1292 A, in the series illustrative of the nervous system of the *Nematoneura* is a star-fish (*Asterias papposa,* Lam.) with the membrane removed from the oral surface of the central disk, to show the simple nervous chord surrounding the mouth and distributing filaments to each ray. These filaments run in the interspace of the tubular feet, extending from between the spines which protect the ambulacral grooves. (*Catalogue.*)

Tiedemann, who discovered the nervous system in these animals, describes it in *Asterias aurantiaca* as composed of a delicate white chord surrounding the mouth, in form of a ring immediately on the external side of the circular vessel

into which the heart opens, and of filaments arising and diverging from the annular chord opposite to the rays—three filaments for each ray—one running along the under surface in the median line, and appearing to send small branches to the feet; the other two, shorter, passing between the first and second segment of the ray into the interior of the body, and probably distributed over the stomach. No ganglia were discovered by Tiedemann, but minute ganglia have been described by others as existing at the points whence the diverging filaments spring. (Grant's *Comp. Anat.*)

Touch.—All of course agree in assigning the sense of touch to the star-fishes, but many would confine their endowment to that sense. Professor Ehrenberg however, who is a keen and accurate observer, is disposed to think that some of them, at least, are gifted with visual organs under the form of a single red speck at the termination of each ray. These specks had been long noticed, but without any determinate conjecture as to their use in the animal economy, till he, struck by their outward resemblance to the eyes of the *Entomostraca* and *Infusoria*, thought that they might be organs of sight, and he traced the long nerve of one ray up to the extremity, where it enlarges into a sort of ganglion connected with the red speck.

Mr. Rymer Jones, after noticing the nervous system of these animals, thus expresses his dissent from Professor Ehrenberg's views:—

'Such an arrangement can only be looked upon as serving to associate the movements performed by the various parts of the animal, for no portion of these simple nervous threads can be regarded as being peculiarly the seat of sensation or perception. But this inference is not merely deducible from an inspection of the anatomical character of the nerves: it is based upon actual experiment. We have frequently, when examining these animals in a living state—that is, when, with their feet fully developed, they were crawling upon the sides of the vessel in which they were confined—cut off with scissors successive portions of the body so as to expose the visceral cavity; but so far from the rest of the animal appearing to be conscious of the mutilation, not the slightest evidence of suffering was visible: the suckers placed immediately beneath the injured part were invariably retracted: but all the rest, even in the same ray, still continued their action, as though perfectly devoid of participation in any suffering caused by the injury inflicted. Such apathy would indeed seem to be a necessary consequence resulting from the deficiency of any central seat of perception whereunto sensations could be communicated: nevertheless Ehrenberg insists upon the existence of eyes in some species of the star-fish, attributing the function of visual organs to some minute red spots visible at the extremity of each ray, behind each of which he describes the end of the long nerve which runs along the ambulacral groove as expanding into a minute bulb. We must however confess that the proofs adduced in support of such a view of the nature of these spots, appear to us to be anything but satisfactory; and as we have already stated in the first chapter the physiological objections which may be urged against the possibility of any localised organ of sense being coexistent with a strictly nematoneurose condition of the nervous system, they need not be repeated here. The general sense of touch in the *Asteridæ* is extremely delicate, serving not only to enable them to seize and secure prey, but to recognise its presence at some little distance, and thus direct these animals to their food. A person who has been in the habit of fishing with a line in the shallow bays frequented by star-fishes, and observed how frequently a bait is taken and devoured by them, will be disposed to admit this; yet to what are we to attribute this power of perceiving external objects? It would seem most probably due to some modification of the general sensibility of the body, allowing of the perception of impressions in some degree allied to the sense of smell in higher animals, and related in character to the kind of sensation by which we have already seen the *Actiniæ* and other polyps able to appreciate the presence of light, although absolutely devoid of visual organs.' (*General Outline of the Animal Kingdom and Manual of Comparative Anatomy.*)

Mr. Forbes, although he admits that the existence of ganglions in the nervous system of these animals is generally regarded as doubtful, seems, from the frequent recurrence of the terms 'eye' and 'eyelid,' to be of opinion that the specks above alluded to are visual organs. (*History of British Star fishes and other Animals of the Class Echinodermata.*)

Our own opinion and observation are in favour of the views of Ehrenberg: and we think that those who have accurately watched the star-fishes which are furnished with these specks on the sea-coast will in general be irresistibly led to the conclusion that the organs, though not eyes in the strict sense of the term, serve the purposes of vision modified to the exigencies of the animal, enabling it to seek or avoid objects according to its will. Nor does analogy, in our view of the case, present any difficulty. We have only to consider that the centre is a head as well as a stomach, a condition that will hardly be denied to it, and the rays proceeding from it may be viewed as so many antennæ—(take those of the snail for example, with their terminal ocular points, as in some degree analogous)—with visual dots at their extremities. This, at all events, may solve the problem of the destructive visitation of these animals to the baited line, more in unison with the analogies than the supposed existence of a general olfactory sense, of whose presence not the slightest trace has been observed.

Locomotive System.—The organs of motion in the *Stelleridans* are various. The rays themselves are moveable; and in the free Stelleridans aid in the removal of the animals from place to place. Thus the common star-fish can bend its rays towards the upper or towards the lower surface of the centre or disk, and can approximate some whilst it extends others: so that they are widely divaricated laterally, and thus facilitate its advance in the water, or its passage through small spaces. In the common star fish these motions are slow, but in *Ophiocoma* they are comparatively rapid, and manifested in active contortions on some occasions. According to M. Sars, the young of *Asterias Sanguinolenta*, which have four short club-shaped appendages or arms at their anterior extremity, move slowly but uniformly in a straight line with their fore-arms foremost. Vibratile cilia are supposed to form the moving power in this case: the arms also enable the little animal to creep at a slow pace along the rocks. When the animal is more fully developed (post, p. 15) the power of swimming ceases.

Tiedemann considers that the power of moving the rays resides in the contractile skin. Meckel states that there are distinct muscles leading between the calcareous plates which form the floor of the rays. Dr. Sharpey has no doubt that the motions are partly effected by the skin, but he had himself observed a distinct band of muscular fibres running along the roof of each ray, between the coriaceous skin and peritoneal membrane when it is stript off.

But the principal locomotive organs of the free Stelleridians, as well as of the *Echinodermata* generally, are the membranous tubes which can be protruded at will through the ambulacral apertures, and which have been termed the feet. The clearest description of this complicated and in some degree obscure apparatus known to us is that by Dr. Sharpey; and we therefore give it in his own words.

'These,' writes Dr. Sharpey, treating of the membranous tubes or feet,' are very numerous, and are usually disposed in regular rows: they contain a clear fluid, which is conveyed to them by a peculiar system of vessels. Each foot consists of two parts, an internal and generally vesicular portion placed within the body, and a tubular part on the outside, projecting from the surface, and continues with the first through an aperture in the skin or shell. The tube is closed at the extremity, and terminates there in a sucker, which has usually the form of a disk slightly depressed in the centre. Both parts of the foot are evidently muscular, the fibres of the tubular portion being disposed in a circular and longitudinal layer; the cavity is lined with a transparent membrane, and the tubular part moreover receives an external covering from the epidermis. The foot is extended by the contraction of its internal vesicle, which forces the fluid into the tube; or when a vesicle is wanting, by the projection of a fluid into the tube from a communicating vessel. The tubular part is thus distended and elongated: it retracts itself of course by its muscular fibres; and when this takes place, the fluid is forced back again into the vesicular or internal part. In progression the animal extends a few of its feet in the direction in which it desires to go, attaches the suckers to rocks, stones, or other fixed objects immediately in advance; then shortening its feet, it draws its body in the wished-for direction. In the star-fish the feet are disposed in rows along the under surface of the

ing, diminishing in size as they approach the extremity. There are usually two simple rows in each ray, and the vesicular part is for the most part deeply cleft into two lobes, as in *Asterias aurantiaca.* In other cases, as *Asterias rubens*, there are two double rows in every ray, and each foot has a round undivided vesicle. The canals or vessels which convey the fluid to and from the feet are all connected with a circular vessel situated in the vicinity of the mouth. This vessel lies immediately within the calcareous ring already described as connecting the rays at the commencement; from it a straight canal proceeds along the floor of each ray in the median line, and in its progress gives off lateral branches, which open into the vesicles of the feet. There are moreover connected with the circular vessel—First, a certain number of bodies (ten in five-rayed species), which Tiedemann compares to glands; they are very small, brown, sacculated organs, each opening by a small orifice into the circular vessel: Tiedemann supposes them to be the source from which the fluid filling the feet is derived.—Secondly, pyriform sacs: in *A. aurantiaca* there are four groups of these; and each group consists of three or four sacs, which open by a common tubular pedicle into the circular vessel. In some other species there are five simple sacs. They are muscular, and Tiedemann conceives them to be the chief agents by which the fluid is forced into the vesicles of the feet, to which they are placed in a sort of antagonism. It would seem however that this purpose may be accomplished by other means; for, according to Meckel's statement, and, we may add, our own observation, they are not present in all species.—Lastly, the circular vessel receives the singular organ named the stone-canal or sand canal by Tiedemann, who describes it as a membranous canal containing a friable mass of sandy or earthy matter, which commences by a wide origin on the inferior or internal surface of the calcareous disk already described as situate on the upper part of the body, descends in a duplicature of fibrous membrane, and opens by a narrow orifice into the circular vessel, the upper or wide end being closed by the disk. Ehrenberg has correctly remarked that this organ is not filled with an amorphous mass of earthy or cretaceous matter: he describes it as exhibiting a dense network of calcareous fibres, with hexagonal and pentagonal meshes, resembling, in some respects, the cavernous structure of the penis. The result of our own examination, in more than one species, is different still. We have always found the earthy matter forming a jointed calcareous tube. This tube, which is about the thickness of a surgeon's probe, is composed of rings of calcareous substance connected by membrane, so that viewed externally it is not unlike the windpipe of a small animal. On cutting it across however it is found to be more complex in structure than appears externally; for it contains within two convoluted laminæ of the same nature as its calcareous parietes. These laminæ are rolled longitudinally: they rise conjointly, or as one, from the internal surface of the tube, pass inwardly a certain way, then separating, are rolled in opposite directions, something after the same manner as the inferior turbinated bone of the ox. These internal laminæ become more convoluted towards the upper end, where at last they, as well as the more external part of the tube, join the dorsal disk, appearing gradually to become continuous with its substance. The disk is perforated with numerous pores, which open into the tube. Tiedemann conceives the function of the sand-canal to be that of secreting the earthy matter required for the growth of the calcareous skeleton. Meckel considered this view as very improbable, and the description we have given does not tend to corroborate it. We must confess ourselves unable to offer more than mere conjecture as to the use of this singular structure. If the fluid contained in the feet and their vessels be sea-water (either pure, or with an admixture of organic particles), which is probable from its chemical composition, may it not be introduced, and perhaps again discharged, through the pores of the disk and the calcareous tube, the porous disk serving as a sort of filter to exclude impurities?' (*Cyclopædia of Anat. and Physiol.*)

Generative System.—The generation of the Stelliridians appears to be monœcious, of that nature which Professor Owen terms *Cryptandrous Hermaphroditism.* Ovaries are, as far as we are aware, the only organs relating to the generative functions hitherto discovered; but Fabricius, in his *Fauna Groenlandica*, would seem to affirm that two individuals are necessary for the propagation of the species, and states that the coition takes place in the month of May—'congreditur oribus arctè connexis, altera supina.' The ovaries, which appear to vary in number in different species, form, in general, an oblong cluster of tubes branching from a single stem, by which the whole is attached, and ending in circular dilated vesicles. In some species, *Asterias aurantiaca*, for instance, the tubes form numerous bundles (about 20), each of which is distinctly attached, so that they are not all connected by a single stem. In the museum of the College of Surgeons (London), No. 2236 is a portion of a star-fish (*Asterias rubens*, Lam.) prepared to show the ovaria, ten in number, attached on each side of the base of each ray, near the angle of divergence; the ova are not developed in this specimen. No. 2237 exhibits an *Asterias papposa*, Lam., with the anterior parietes of one ray, and the posterior parietes of another ray, dissected off, showing the ovaria with the ova at the commencement of their development. The ovaria are two in number in each ray, as in the preceding species, and are similarly attached on each side of the base of the ray, where they may be distinguished from the digestive and locomotive cæca by their greater opacity and granular structure. No. 2238 is the same species with the posterior parietes of the central disk removed, showing the commencement of the digestive cæca and the ovaries. No. 2239 is a portion of one of the rays of *Comatula solaris*, Lam., showing the ovarian receptacles occupying the inner side of each of the pinnæ, or articulate processes sent off from the rays. Three of the receptacles are laid open to expose the contained ova. (*Catalogue, Physiol. Series.*)

M. Sars states that the young of *Asterias Sanguinolenta* immediately after birth have a depressed and rounded body with four very short club-shaped appendages or arms at their anterior extremity, as above stated. When they are a little more developed, papillæ disposed in five radiating rows on the upper surface may be distinguished. At the expiration of twelve days, the five rays of the body, which up to that time had been rounded, begin to increase; and at the conclusion of eight days more, the two ranges of feet or tentacula are developed under each ray, and assist in the locomotion of the animal by alternate elongation and contraction, and performing the office of suckers.

Skeleton and Dermal Envelopement.—The integuments of a star-fish are—1, a leather-like tough membrane in which portions of calcareous matter, which may be termed the skeleton of the animal, are imbedded; 2, an external membrane of a softer texture; 3, certain appendages. 'The calcareous pieces,' writes Dr. Sharpey, *loc. cit.*, 'form inferiorly a ring round the mouth and a series of transverse segments placed in succession along the floor of each ray. The first of these segments is connected with the ring; they decrease in size as they approach the point or distal end of the ray, and openings are left between them for the passage of the feet. In the *Asterias rubens*, which has five rays, the central ring consists of ten larger and five smaller pieces, the former disposed in pairs opposite the commencement of the rays, the latter corresponding to the angles between the rays. The segments of the rays are symmetrical; in the species mentioned they consist of two oblong pieces united in the median line, and two smaller ones placed laterally. On the sides of the ray the calcareous substance is disposed, as it were, in ribs; these rise from the floor at first nearly parallel with each other, and are connected by cross bars, but on approaching the upper part or roof of the ray they cross in all directions and form an irregular network, the intervals of which are occupied by softer integument. The ribs and bars are made up of small pieces joined by plane but oblique surfaces, a mode of construction calculated to admit of their being lengthened and shortened upon one another, and thus to allow the cavity they surround being dilated and contracted. A broad calcareous disk is situated on the upper surface of the body, in the angle between two of the rays, which is connected internally with the sand-canal. The calcareous pieces are of a homogeneous structure, without cells or fibres; they consist, according to Hatchett's analysis, of carbonate of lime, with a smaller proportion of phosphate of lime. The coriaceous membrane which connects the pieces of the skeleton is made up of white glistening fibres. It is contractile and irritable, for it slowly shrinks on being scratched with the point of a knife, or when it is cut through. The external membrane is much thinner and softer than that just described; in various parts it is coloured, or in these parts there is a coloured layer underneath it. The appendages or processes on the surface

of the body are of three kinds. First, calcareous spines; these are found over the whole surface, except the grooves for the feet. They are attached by a moveable joint at their base to the calcareous pieces of the skin, and are invested by the external soft membrane nearly as far as their point. Those on the upper surface are solitary, short, and for the most part club shaped, their broader summit being marked with radiating points; whence they were named stelliform processes by Tiedemann. On each side of the groove for the feet, the spines are thickly set; these in *Asterias rubens* have three rows, in the middle and innermost of which they are placed three deep. On this part of the surface they are also longer and pointed. The spines are slowly moved at the will of the animal. The appendages of the second kind are of a very singular nature; they have the appearance of pincers of crab's claws in miniature, and were described by Müller as parasitical animals under the name of *Pedicellaria*. Monro gave the name of antennæ to analogous organs which are found on the sea-urchin. They probably do not exist in all species, for Tiedemann makes no mention of them in his description of *A. aurantiaca*. In *A. rubens* they cover the surface generally, and form dense groups round the spines. Each consists of a soft stem, bearing on its summit, or (when branched) at the point of each branch, a sort of forceps of calcareous matter not unlike a crab's claw, except that the two blades are equal and similar. When the point of a fine needle is introduced between the blades, which are for the most part open in a fresh and vigorous specimen, they instantly close and grasp it with considerable force. The particular use of these prehensile organs is not apparent; their stem, it may be remarked, is quite impervious. The third sort of appendage consists of those which are named the respiratory tubes.' In the other Stellridians the same general construction of the skeleton may be observed; but the modifications differ with the forms. In some it consists of hundreds of pieces disposed in various patterns, and fitting with the most minute accuracy. In some these pieces are soldered together, as in the calcareous central purse from which the arms of the *Ophiuræ* radiate; and in others they are united by ligaments, as in the rays of these *Ophiuræ*, the *Gorgonocephali*, and the *Encrinites*.

Voluntary dismemberment; and restoration of lost or injured parts.—The sudden and voluntary act of dismemberment by which many of the Stellridians will save their central disk at the expense of their rays or arms must have struck those who have observed these animals in their native seas, as well as the length of time during which the severed parts still continue to be endowed with motion. This power of dismemberment seems to be carried to its fullest extent in *Ophiocoma* and *Luidia*, and we refer our readers to Mr. Forbes's account of the voluntary breaking up of these genera, especially the latter, in his highly interesting *History of British Star-fishes*, &c. above alluded to.

With regard to the power of restoration, few collectors have not come into possession of a specimen with a budding or growing ray occupying the place of a lost one. Such a case is figured in the article ENCRINITES, vol. ix., p. 390. Jussieu, Guettard, and Gerard de Villars brought to Reaumur specimens of star-fish with four large rays and a small one still growing; they found others, he tells us, with only three large rays and two very small ones; and others with two large rays and three very small, and, as it seemed, very young ones. More than once they met with a large ray, from which four young rays had begun to sprout. Reaumur speaks of the fact as being well known to the fishermen, and in allusion to certain experiments which Jussieu and Guettard had been carrying on, he remarks that the portions into which they had divided the animals appeared to go on well, the wounds healed and consolidated; but he adds, that those who made the experiment were obliged to limit their stay on the coast to about fifteen days; too short a period, he observes, to trace the progress of a reproduction which apparently requires several months, or perhaps even more than a year for its completion.

Systematic Arrangement.

Link, in his volume *De Stellis Marinis* (fol., Leipzig), arranges and figures a considerable number of species, in the method of which the outline is here given.

Section I.

De Stellis fissis.

Class 1.

Oligactis (Star-fishes with fewer than five rays)

Genera, *Trisactis*, *Tetractis*.

Class 2.

Pentactinodos (Quinquefid star-fishes).

Genera, *Pentagonaster*, *Pentaceros*, *Astropecten*, *Palmipes*, *Stella coriacea*, *Sol marinus*, *Pentacdylosaster*.

Class 3.

Polyactinodos (Multifid star-fishes).

Genera, *Hexactis*, *Heptactis*, *Octactis*, *Enneactis*, *Decactis*, *Dodecactis*, *Triscaidecactis*.

Section II.

De Stellis Integris.

Class 1. Stellarum vermiformium.

Genera, *Stella lumbricalis*, *Stella scolopendroides*.

Class 2. Stellarum crinitorum.

Genera, *Decacnemos*, *Triscaidecacnemos*, *Caput Medusæ*.

Class 3. Astrophyton.

Genera, *Arachnoïdes*, *Astrophyton costosum*, *Astrophyton scutatum*.

Linnæus divided his genus *Asterias* into the following sections:—

1. *Integræ*.

Example, *Asterias Luna*, the only species.

2. *Stellatæ*.

This section contained nine species. Example, *Asterias papposa*.

3. *Radiatæ*.

Containing six species. Examples, *Asterias Ophiura*, *Ast. Caput Medusæ*, &c.

Position of the genus between *Medusa* and *Echinus*.

Gmelin arranged the genus in three sections also, retaining the names of Linnæus for the two last; but altering that of the first, under which he includes four species, to *Lunatæ*.

Position of the genus, between *Physsophora* and *Echinus*.

Lamarck, who, according to M. de Blainville, 'a suivi à peu prês les erremens de Link dans la distribution systematique des Stellérides,' arranged them as the first section or family of the *Echinodermatous Radiata*, and separated them into the genera *Comatula*, *Euryale*, *Ophiura*, and *Asterias*.

The number of recent species of *Comatula* (*Alecto*, Leach; *Antedon*, From.) recorded in the last edition of Lamarck is ine. From these Agassiz separates *Comatula multiradiata* for the type of his genus *Comaster*. The same author considers the *Ganymeda* of Gray to be the isolated disk of some species of *Comatula*.

We must here notice *Holopus*, a new genus of the Crinoidean family [ENCRINITES] characterised by M. d'Orbigny from the stony skeleton (squelette pierreux) of a species fished up alive at Martinique and brought home by M. Rang, and named by M. d'Orbigny *Holopus Rangii*.

Generic Character.—Animal fixed to the ground by a root taking the form of the solid bodies upon which it attaches itself. From this root or base springs a foot or entire body, which is short, thick, and hollow, containing the viscera, and opening in a mouth, which fulfils at the same time the functions of an anus placed in the bottom of an irregular cavity formed by the reunion of dichotomous, thick stony arms, convex externally, hollowed into gutters within, divided into numerous articulations, and furnished alternately along their length with small conical ramules, which are strongly compressed. (D'Orb.)

Upon this M. Dujardin remarks that the author, having seen no more than the stony skeleton, has been only able to conjecture the position and structure of the viscera; and that analogy would lead to the supposition that there is a distinct anus, as in *Comatula*. The individual described was about three inches (French) in height.

The genus *Euryale* (*Astrophyton*, Link; *Gorgonocephalus*, Leach; OPHIURA, vol. xvi., p. 450) consists of six species, from which Agassiz separates such species as *Euryale palmifera* [OPHIURA, loc. cit.] under the generic name of *Tricaster*.

Ophiura is divided by Lamarck into two distinct sections: 1st, Those species which have the rays rounded or convex on the back. 2nd, Those species which have the rays flattened on the back, *i.e.* above as well as below. Then comes a crowd of species under the title of 'Espèces que je n'ai point vues.'

We shall presently see that M. de Blainville divides the *Ophiuræ* according to the length and disposition of the spines, without regard to the cylindrical or flattened character of the rays employed by Lamarck.

Agassiz divides the *Ophiuræ* into five sections:—

1. *Ophiura.*

Those species which have the disk very much depressed, the rays simple, scaly, and furnished with very short spines, and embracing or close down upon the rays.

Example, *Ophiura texturata, lacertosa,* Lam.

2. *Ophiocoma.*

Those species which differ from the preceding by having very long and moveable spines upon the rays.

Example, *Ophiura squamata, echinata,* Lam.

3. *Ophiurella (fossil only).*

Those species whose disk is hardly distinct.

Examples, *Ophiura carinata,* Münst.; *Egertoni,* Brod. (see post, p. 18).

4. *Acroura* (fossil only).

Differing only from *Ophiura* in having spines on the sides of the rays instead of scales, while the rays themselves are very slender.

Examples, *Ophiura prisca,* Münst., *Acroura Agassiz,* Münst.

5. *Aspidura* (fossil only).

Having the upper surface of the disk covered by a star of ten plates, whilst the rays, which are proportionally stout, are surrounded by imbricated scales. (*Ophiura loricata,* Goldf.)

Asterias is arranged by Lamarck under the following divisions:—

1.

Those species which have the body scutellated. These are numerous, and comprise the genera *Scutaster, Plataster, Palmaster,* and *Solaster* of De Blainville.

2.

Those which have the body radiated, consisting of numerous species also, and comprising the genera *Solaster* and *Pentaster* of De Blainville.

The *Stellerideæ,* in Lamarck's arrangement, are immediately followed by the *Echinidæ.*

Cuvier makes the *Echinodermes* the first class of zoophytes, and the *Pedicellés* the first order of that class, observing that Linnæus established three genera of them (meaning apparently the three divisions above stated), which are very natural but numerous enough, and comprise species sufficiently varied to be considered as three families.

Cuvier divides the species into—

1st. *Les Astéries* (*Asterias,* Linn.), commonly called *sea-stars.* He recognises some of the genera of Leach and Lamarck, and observes that the *Encrinites* (*Encrinus,* Guettard) ought to be placed near the *Comatulæ.*

The *Oursins* (*Echinus,* Linn.) immediately follow the sea-stars.

M. de Blainville divides the Stelliridians into three families:—1, Those with a stelliform body; 2, those with a disciform body; 3, those with a cupuliform body.

1. *Asteridians.*

Genus *Asterias,* comprising the following divisions or sub-genera:—

A.

Species whose body is pentagonal, and but little or not at all lobated on its circumference; the angles being fissured (*Les Oreillers*).

Example, *Asterias Luna.*

B.

Pentagonal species: delicate, and, as it were, membranous (*Les Palmastéries—Palmipes* of Link).

C.

Quinquelobated species, which are not articulated on the circumference.

Example, *Asterias minuta,* Linn. (*Pentaceros,* Link; *Asterina,* Nardo.)

D.

Pentagonal species more or less lobated and articulated at their circumference (*Les Scutastéries,* or *Platastéries*).

Example, *Asterias tessellata.* [ASTERIAS.]

M. de Blainville remarks that the species of this section, many of which exist in the European seas, do not appear to him to have been examined by zoologists with sufficient accuracy; and he thinks that many species have been confounded under the same name.

E.

Species deeply divided into five rays (*Pentastéries*).

*

Triangular, depressed, and articulated on the edges (*Astropecten,* Link: *Crenaster,* Lhuyd).

Example, *Asterias aurantiaca,* Lam.

* *

Triangular, rather short, and rounded above.

Example, *Asterias rubens,* Lam. (*Uraster,* Ag.)

* * *

Rays long, strait, and often narrowed at their origin.

Examples, *Asterias variolata, Asterias* ? *unifera,* Lam.

De Blainville remarks that the species which enter into this section are numerous, but that their distinction is not yet sufficiently established. He is certain, for example, that four species have been confounded under the name of the Fringed Star (*Astérie frangée*). On the other hand he thinks that those of the last section may have been too greatly multiplied.

F.

Species which are divided into a greater number of rays than five or six. [SOLASTERIES.]

Examples, *Asterias tenuispina; Ast. endeca; Ast. papposa.*

II. *Asterophidians.*

Genera, *Ophiura, Euryale.*

Ophiura

A.

Species the spines of whose rays are very short, and applied upon the latter.

Example *Ophiura texturata,* Lam.

B.

Species the spines of whose rays are long, and not applied upon the latter.

Example, *Ophiura squamata,* Lam. [OPHIURA.]

Euryale.

A.

Species whose rays dichotomize but little, and far from the root.

Example, *Euryale palmifera,* Lam.

B

Species whose rays divide and dichotomize from the base.

Example, *Euryale scutata* [OPHIURA.]

III.

Asterencrinidians

1.

Free *Asterencrinidians.* Example, COMATULA.

2.

Fixed Asterencrinidians.

Genera, *Encrinus: Phytocrinus**: *Pentacrinus; Apiocrinites: Poteriocrinites: Agathocrinites: Actinocrinites: Rhodocrinites: Platycrinites; Caryocrinites; Marsupites: Pentremites.* [ENCRINITES.]

Agassiz also divides the Stelliridians into three families or principal sections, but he gives them different names.

1st. *Asterians,* consisting of those species which have for their digestive organ a single orifice surrounded by suckers, but deprived of teeth; a madreporiform tubercle on the back between the two posterior rays, and deep furrows occupied by many rows of pedicles, going from the mouth to the extremity of the arms.

2nd. *Ophiurians,* comprising those whose body forms a flattened † and distinct disk, to which are annexed more or less elongated or even ramified rays, deprived of furrows on their lower surface.

3rd. The *Crinoidians,* having two separate, but closely approximated orifices to the intestinal canal; and being for the most part fixed by the dorsal surface, by means of an articulated pedicle.

Before we enumerate the genera into which this zoologist divides *Asterias,* we must notice the division of M. Nardo, who had previously proposed the following:—*Stellonia* (*Ast. aranciaca—Ast. calcitrapa*); *Stellonia* (*Ast. rubens—Ast. glacialis*); *Asterina* (*Ast. exigua—Ast. minuta*); *Anseropoda* (*Ast. membranacea—Ast. rosacea*); *Linckia* (*Ast. lævigata—Ast. variolosa*).

The following is the division of Agassiz:—

1. *Asterias* (*Astropecten,* Link; *Crenaster,* Lhuyd; *Pentaster,* Bl.; *Stellaria,* Nardo).

2. *Cœlaster,* Ag., differing from the preceding in having the interior cavity circumscribed by plates disposed like those of the *Echini,* at the summit of which may be perceived a star with ambulacra. A genus approaching the

* N. B. This character must be received with great caution; the disk of those *Ophiuræ* known to us is plumped out, so to speak, when they are alive; though in the dead and dried specimen it is flat.

* A young *Comatula.* † See note in opposite column.

Crinoïdians in its organization, whilst its general form is that of the true star-fishes. Example, only one species, and that fossil, *C. Conltoni*, Ag.

3. *Goniaster*, Ag. (*Scutaster* or *Peltaster*, Bl.) Examples, *Ast. tessellata*, Lam.—*Ast. equestris*, Lam.

4. *Ophidiaster*, Ag. Example, *Ast. ophidiana*, Lam.

5. *Linckia*, Nardo. Example, *Ast. variolata*, Lam.

6. *Stellonia*, Nardo (*Pentaster* in part and *Solaster* in part Bl.) Examples, *Ast. rubens*: *Ast. glacialis*: *Ast. endeca*: *Ast. papposa*: *Ast. Helianthus*, &c.

7. *Asterina*, Nardo (*Asterias*, sect. C., Bl., *Pentagonaster*, Link). Example, *Ast. minuta*.

8. *Palmipes*, Link (*Palmaster*, Bl., *Asteropoda*, Nardo). Example, *Ast. membranacea*.

9. *Culcita*, Ag. (*Oreaster*, Bl.) Example, *Ast. discoidea*.

Mr. G. R. Gray makes the *Hypostoma* the second class of the first section (*Echinodermata*) of his sub-kingdom *Centronia*.

The *Hypostomata* consist of two orders:—1. *Asteroida*; 2. *Ophiuroida*.

Asteroida.

Fam. 1. *Asteriadæ*. Genera, *Asterias*; *Heliaster*; *Tonia*.

Fam. 2. *Astropectinidæ*. Genera, *Nauricia*: *Astropecten*: *Luidia*, *Pentalaster*; *Solaster*: *Polyaster*: *Henricia*.

Fam. 3. *Pentacerotidæ*. Genera, *Culcita*: *Pentaceros*; *Stellaster*, *Hippaster*; *Calliaster*; *Goniaster*; *Echinaster*: *Gymnasteria*: *Dactylosaster*; *Stelloma*; *Cribrella*; *Linckia*.

Fam. 4. *Asterinidæ*. Genera, *Palmipes*, *Asterina*.

Ophiuroida.

Fam. 1. *Ophiuridæ*. Genera, *Ophiocoma*; *Ophiura*: *Rosula*, *Aspidura*: *Ophiurella*; *Anoura*.

Fam. 2. *Euryalidæ*. Genera. *Astrophyton*: *Euryale*: *Nebulia*: *Trichaster*.

The third class is named *Blasteroida*: and consists of one family—*Pentremitidæ*, comprising the genera *Pentremites* and *Orbitremites*.

The fourth class is named *Sphæronoidea*, and comprises the genera *Sphæronites*; *Hemicosmites*, and *Cryptocrinites*.

The fifth class, *Crinoidea*, is divided into four families;

1. *Pentacrinitidæ*. Genera, *Comatula*; *Pentacrinites*, &c.

2. *Apiocrinitidæ*. Genera, *Apiocrinites*. *Holopus*, &c.

3. *Cyathocrinitidæ*. Genera, *Cyathocrinites*: *Marsupites*.

4. *Asterocomidæ*. Genus, *Asterocoma*. (*Cat. Brit. Mus.*, 1840.)

Early in the same year, Müller of Berlin read his paper on the genera of star-fishes to the Berlin Academy, in which the anus or anal pore is employed as characteristic of family distinction. This aperture is described as present in all star-fishes, excepting *Asterias* proper and *Hemicnemis*, which, according to Mr. Forbes, seems to be identical with his previously established *Luidia*. 'His genus *Crossaster* also,' says Mr. Forbes, 'is my *Solaster*, published a year before. Several generic names, previously adopted by Agassiz and Nardo, are wantonly changed; thus *Craster* is turned into *Asteracanthion*, and *Palmipes* into *Asteriscus*, with which he unites *Asterina*. In this paper Müller maintains that one of the five intermediate inferior plates of the *Ophiuridæ* bears a madreporiform tubercle, or rather corresponds to that body, a view which I am not inclined to adopt.'

With regard to *Solaster*, we have seen how long ago *Solastère* was used by De Blainville; but the practice of wantonly changing names is productive of so much confusion that it cannot be too strongly reprobated. Mr. Forbes admits, as all indeed must, that the generic characters in Müller's papers are excellently drawn up; and no difference of opinion can exist as to the great general value of the memoir.

Of Mr. Gray's arrangement Mr. Forbes says, 'The other memoir to which I must allude is one by Mr. Gray on the Starfishes, wherein he calls the class *Hypostoma*, and defines somewhat ambiguously, published simultaneously with my two first numbers,* in the *Annals of Natural History*. I am afraid I must censure Mr. Gray for changing names still more than Müller, and with less reason. It is a pity zoologists do not take a lesson from their fellow-labourers in the field of nature, the botanists, in this respect. Mr. Gray has increased the confusion by giving fragments of descriptions instead of genuine and specific characters, probably from carrying too far a laudable desire for brevity. His essay deserves praise however for recording many new foreign habitats of the beautiful animals he catalogues.'

* October and November, 1840.

In the same work* Mr. Forbes has arranged the *Echinodermata* in six orders, the three first of which are conversant with the Stelleridans:—

'I. *Pinnigrada*. *Crinoidea*.—First appearance of cirrhi, springing from brachial membranes, which, with the true arms, form the organs of motion.

'II. *Spinigrada*. *Ophiuridæ*.—Disappearance of brachial membranes, cirrhi as before: true arms clothed with spines for motion.

'III. *Cirrhigradæ*. *Asteriadæ*.—Arms disappear; body more or less lobed, and lobes channelled beneath for cirrhi, which act as suckers, and are the organs of motion.'

He looks upon the *Echinodermata* and *Arachnodermata* as two parallel groups, and holds it as a law that the divisions of parallel groups should be based on a common principle. (Introduction, p. xiv.)

Fossil Stelleridans.

The number of fossil species of Comatula given in the last edition of Lamarck is five, including *Comatula Wagneri*, Münst., which is marked with a ? All these are from the lithographic slate of Solenhofen, and all but the last are figured by Goldfuss (*Petref.*); but Agassiz considers the species published by Goldfuss as belonging to different genera. Thus, on *Comatula pectinata*, Goldf., he establishes the genus *Pterocoma*, characterized by its pinnated rays, which are so developed and bifurcated that the disk would seem to be null: whilst he refers the three other species, *Comatulæ tenella*, *pectinata*, and *filiformis* to the genus *Saccoma*, which has the disk in the form of a rounded pouch, on the border of which are articulated five slender rays, simply bifurcated up towards their base and pinnated. The same zoologist views the *Glenotremites paradoxus* of Goldfuss, a fossil from the chalk, as the isolated disk of a species of *Comatula*.

For the fossil Encrinites in general, the reader is referred to that article; but we must here advert to the genera *Hypanthocrinites* and *Dimerocrinites*. These Crinoidean genera are established and described by Professor Phillips in Murchison's *Silurian System*, where they are beautifully figured, with other Encrinites, in plates 17 and 18. Both genera are from the Wenlock limestone. Mr. Murchison states that columns and plates of *Crinoidea* occur in all the Silurian formations, from the Upper Ludlow Rock to the base of the Llandeilo flags, and also in the underlying Cambrian Rocks; but he adds that clearly determinable species have as yet been found in the Wenlock limestone only.

M. Hermann von Meyer has lately characterised two new genera of *Encrinites*, viz. *Isocrinus* and *Chelocrinus*.

The last edition of Lamarck records eight fossil species of *Ophiura*, including *Ophiurella*, Ag. (*Ophiura carinata*, Münst.; *Oph. speciosa*, Münst.; *Oph. Milleri*, Phil.; and *Oph. Egertoni*, Brod.): *Acroura*, Ag. (*Oph. prisca*, Münst.); and *Aspidura*, Ag. (*Oph. loricata*, Goldf.). Of these, *Ophiuræ speciosa* and *carinata* are from the lithographic slate of Solenhofen; *O. prisca*, from the muschelkalk of Baireuth: *O. loricata*, from the muschelkalk of Würtemberg, *O. Egertoni*, from the lias at Lyme Regis; *O. Milleri*, from the Yorkshire lias; a nameless species from the same locality (Williamson, *Mag. of Nat. Hist.*, 1836); and *O. Agassiz*, from the muschelkalk.

Thirteen species of fossil *Asterias* are given in the last edition of Lamarck from the lias of Coburg and Bamberg, the lias and muschelkalk of Würtemberg, the upper arenaceous beds of the Westphalian Jurassic formation; the Jurassic limestone of Würtemberg and Baireuth; siliceous from the upper beds of the Jurassic limestone of Baireuth; in the Jurassic limestone of Baireuth; the lower oolite, and the Yorkshire lias. Of these, *Asterias tabulata*, Goldf., from the upper argillaceous beds of the Jurassic limestone of Baireuth; *Ast. scutata*, Goldf., siliceous from the upper beds of the same Jurassic limestone; and *Ast. stellifera*, Gold., from that limestone, are only established

* 'History of British Star-fishes,' &c., 8vo., London, 1841.

† See the article, in which this term—De Blainville writes it *Cirrhigrada*—is employed for the order (the 2nd) of *Arachnodermata*, comprising the genera *Velella*, *Rataria*, and *Porpita*.

on detached osseous pieces, and Agassiz suspects that they are the *calices* of unknown Crinoidians

Dr. Mantell notes two species of *Pentagonaster*, *Semilunatus* being one, in the chalk formation at Lewes.

Mr. Gray has lately established two fossil genera of Star-fishes—*Comptonia*, from the Whetstone pits in the green sand of Blackdown; and *Fromia*, comprehending the tessellated Star fishes found in the chalk.

M. Dujardin observes that M. Desmoulins has described (*Act. Soc. Linn. Bord.*, t. v., 1832), under the names of *Asterias portoïdes*, *A. lævis*, and *A. Adriatica*, the insulated small bones (osselets) of star-fishes (*Asterias*) coming from the tertiary formation; and that the same author gives the names of *A. stratifera*, *A. chilopora*, and *A. punctulata* to other *osselets* of *Asterias* found in the chalk formation; but M. Dujardin observes that the characters could only be taken from the very variable form of these osselets, and the more or less smooth, or more or less punctated and granulated, state of their external surface, and consequently they do not appear to M. Dujardin to possess sufficient value. In truth, he adds, as much might be said of many of the species established by Goldfuss, and also of two established by Agassiz under the names of *Goniaster porosus* and *Gon. Couloni*, on some osseous pieces of *Asterias* found in the chalk formation. He adds that it is at least permissible to think that many of the objects studied and classed by MM. Desmoulins and Agassiz ought to be referred to the *Asterias quinqueloba* of Goldfuss, which is also found in the chalk.

STELLI'NI. [PADOVA (Town).]

STEM, in Botany, is that part of the plant which seeks the light and developes itself in the air, forming its ascending axis, and grows in an opposite direction to the root or descending axis. Although some plants are said to be without stems or roots, this cannot be absolutely true, as all plants develop themselves in two directions, upwards and downwards; the one growth forming the stem, the other the root.

The stem, or ascending axis, is composed of fibrous, spiral, and cellular tissues, arranged in various ways, mostly assuming a cylindrical form, and having a perpendicular direction, and bearing upon it the various parts of the plant. Its form and direction are however subject to much variation in particular cases. In their internal structure stems present three principal modifications characteristic of the three great natural classes into which the vegetable kingdom is divided, viz. exogens, endogens, and acrogens. The stems of exogens are the most complicated in structure: they possess a central pith, and radiating medullary rays filled up with woody tissue, which is deposited in zones of yearly growth, and the whole is covered with an external bark. [EXOGENS.] The stems of endogens possess no pith or medullary rays or bark, but the same tissues which exist in the exogens are distributed irregularly throughout the mass of the stem. [ENDOGENS.] In their mode of growth they also differ, for whilst the increase of the exogenous stem takes place from the centre towards the circumference, the endogenous stem deposits its tissues from the circumference towards the centre. In acrogens the stem is mostly composed of cellular tissue, and only in a few of the higher orders does it possess a cylindrical form. Of these, the stems of tree-ferns are most conspicuous, which contain, in addition to the cellular tissue, both woody and vascular tissue in their structure. The mode of development of the stem of acrogens is also different from that of the others. 'Instead of its increasing by the deposition of matter originating in the leaves, it appears to be a mere extension of some common vegetating point, which becomes cylindrical and long, when it is capable of being acted upon by the influence of light, as in Ferns, Lycopodiaceæ, &c., which expands irregularly and remains flat and foliaceous in such orders as Hepaticæ and many Algæ, which develops in straggling threads in some of the latter, and which collects these threads into masses of reproductive matter in Fungi.' (Lindley, *Natural System*, p. 395.) Although the character of the stem in the large bulk of the orders will at once point out the class to which they belong, yet there are exceptions, and in many instances the structure of the stem would be no guide to its class. This is particularly seen amongst those orders which grow in damp, marshy, and watery places. Thus *Pilularia*, *Marsilea*, *Isoetes*, and *Salvinia*, amongst acrogens: *Naias*, *Caulinia*, *Zannichella*, *Zostera*, and *Potamogeton* amongst endogens; and *Hippuris*, *Myriophyllum*, *Callitriche*, *Trapa*, and *Ceratophyllum* amongst exogens, have a structure closely resembling each other, from which alone the class to which they belong could not be assigned.

Although the most common direction taken by the stems of exogenous and endogenous plants is vertical, yet a great number of them depart from this course, and on this account, or for some peculiarity of form or function, they have received a variety of distinctions. In some plants the stem or primary ascending axis is never pushed above the surface of the earth, and hence stems thus formed are called *subterraneous*. These stems were mistaken by older botanists for roots, and this error is still frequently committed, but the mode of their growth and their structure will always at once distinguish the subterranean stem from the root. [ROOT.]

A common form of the subterranean stem is the *tuber*, of which a good example is afforded in the potato. The tuber is in reality only the thickened part of a subterranean stem, as may be easily seen on examining a bunch of these in the common potato. The tuber mostly produces at irregular intervals buds which are called eyes, any one of which, being removed by a knife, is capable of existing, and forming, when planted, an independent plant. Tubers frequently contain amylaceous matter, and on this account are nutritive, and used as articles of food.

The *cormus* is another form of subterranean stem. It is only seen in endogenous plants, forming a dilated basis from whence the leaves and flowers spring. It is often mistaken for a bulb, but differs from that organ in being entirely solid. The crocus, the colchicum, and the arum afford examples of this form of the stem.

The *soboles*, or creeping stem, is a form of the subterranean. It runs along horizontally under the surface of the earth, giving off at intervals roots and buds. It is frequently called a creeping root. The best example is the couch or spear grass. It is on account of the facility this kind of stem affords to growth, that this weed is so difficult of eradication. Only a small portion left in the earth will be found sufficient to reproduce the plant, which soon rapidly spreads by means of its creeping stems.

Those stems which appear above the surface of the earth are called *aerial*. Of these the following forms are commonly distinguished:—The *root stock*, or *rhizoma*, is a prostrate hardened stem, scarcely distinguishable from roots, giving off branches or young plants. It is seen in the *Aspidium Filix mas*, *Pteris aquilina*, *Juncus effusus*, *Iris germanica*, *Nymphæa alba*, *Gratiola officinalis*, &c. The *surculus*, or *Sucker*, 'is a branch which proceeds from the neck of a plant beneath the surface, and becomes erect as soon as it emerges from the earth, immediately producing leaves and branches, and subsequently roots from its base.' (Lindley.) This term has been very variously used by botanists, but the above definition expresses its most frequent and legitimate application. Link uses the word *soboles* synonymously with it. The *stolo* is only a modification of the sucker. The *runner* (*sarmentum*, *flagellum*) is a long slender stem, running upon the ground and forming at its extremity roots and a young plant. This is seen in the strawberry. In Orchidaceæ, the leaves and flowers are developed from the apex of an oblong green body which in its structure resembles a tuber, but it is above ground; this form of stem, peculiar to Orchidaceous plants, is called a *pseudo-bulb*.

The stem, being the primary axis of the plant, necessarily supports all the other organs. The first of these which are developed is the leaves, which grow from a point of the stem called the *node*. These nodes are either opposite each other or alternate on the stem, and the space between them is called an *internode*. The internode is composed of tissues which are arranged parallel in a vertical direction; but when a node is formed, the tissues take a horizontal direction, passing into the leaf at an angle with the stem. At this point the tissues are more or less contracted, from the suspended vertical development, and in some plants this is very evident, as in many Lamiaceous plants, the grasses, and the bamboo. The point of union between the leaf and stem is called the *axil*, and at this point is constantly developed a bud. [LEAF-BUD.] Although in all cases this bud does not come to perfection, it is always a consequence of the existence of a leaf. The consequence of the growth of a bud is the formation of a branch (*ramus*). When the branches are numerous, the smaller ones are called *ramuli*,

and a collection of branches forming the head of a forest tree is called a *coma*.

The functions of the stem are to support the various organs of the plant, to serve as a medium for conveying the sap from the roots to every other part, and to become the depository in many plants of their various secretions.

(For farther information see SAP; SECRETIONS, VEGETABLE; ROOT; TISSUES, VEGETABLE.)

STE'MMATOPUS. [SEALS, vol. xxi., p. 164.]

STENCILLING. [PAPER-HANGING.]

STENEOSAURUS. [CROCODILE, vol. viii., p. 168.] Professor Owen, in his *Report on British Fossil Reptiles* to the British Association for the advancement of Science, retains the generic name *Steneosaurus* (proposed by Geoffroy St. Hilaire, for the gavial-like crocodilians with subterminal nostrils, but applied by the latter to species with vertebræ of two distinct systems, and altogether rejected by M. Hermann Von Meyer) for that section of the Geoffroyan genus which includes the species with vertebræ concave at both extremities, as in the genus *Teleosaurus*.

Remains of the genus thus circumscribed occur in the Kimmeridge clay at Shotover, and in the great or middle oolite. [STREPTOSPONDYLUS.]

STENO, NICHOLAS, was born in 1638, at Copenhagen, and there also first studied the medical and other sciences. Bartholin was his preceptor in anatomy, and induced him to pursue it with an ardour which was crowned with eminent success. Having left Copenhagen, Steno studied for three years at Leyden, and for two at Paris, and then travelled through the greater part of Germany and Italy. At Florence, Ferdinand II., grand-duke of Tuscany, appointed him his physician in 1667; and Cosmo III., the next duke, retained him in the same post, and made him tutor to his son. In 1669 Steno renounced the Lutheran faith, in which he had been born and educated, but in which his confidence had been shaken during his residence at Paris by Bossuet, and embraced the Roman Catholic religion. Soon after, Frederic III. of Denmark recalled him, but it was not till Christian V., who was more tolerant of Steno's new faith, succeeded, that he was induced to accept the professorship of anatomy at Copenhagen. He held the appointment for only a short time, and then returned to Florence, where, in 1677, giving up the study of anatomy, he took holy orders, and was consecrated bishop of Heliopolis. Soon after, having been invited to the court of Hanover, the pope made him vicar apostolical of the churches in the north, and in this office he remained, devoting himself zealously to his religious duties till 1679, when a Lutheran prince succeeding to the government of Hanover, he was obliged to quit the country. He retired to Münster, and there and in other parts of Germany he continued sedulously preaching till 1686, when he died at Schwerin in Mecklenburg.

Steno is now known chiefly through the results of his anatomical labours, which, considering the short period occupied in them, were neither few nor unimportant. In his inaugural dissertation, published in 1661, he described accurately the salivary glands and their ducts, and especially that of the parotid gland, which Casserius had regarded as a ligament, and which has since been commonly called Steno's duct, though it had been before his time observed by Gerard Blasius. In another small treatise Steno first described the ducts of the lachrymal gland. His principal work, 'On the Muscles and Glands,' &c., was published in 1664, and contains, among many excellent anatomical descriptions, the first good account of the course of the muscular fibres of the heart, the tongue, and the pharynx, and of the anatomy of the respiratory muscles. It includes also most of his observations on the lymph and lymphatics. In his 'Discourse on the Anatomy of the Brain,' Paris, 1679, Steno speaks of its fibrous structure, and urges the propriety of tracing more carefully than had been hitherto done the course of the nerves into its interior. He wrote also several papers in the 'Acta Hafniensia,' containing some excellent observations on the motion of the heart in living animals, on the nature of the ovaries and the ova of quadrupeds, and on the development of the chick. A brief account of his researches is published in Haller, 'Bibliotheca Anatomica,' tom. i., p. 491.

STENODA'CTYLUS. [GECKO, vol. xi., p. 103.]

STENODERMA, M. Geoffroy's name for a genus of Bats. [CHEIROPTERA, vol. vii., p. 26.]

STENOGRAPHY, or the art of short-writing, is a term compounded of two Greek words, στενός, contracted, and γράφειν, to write. The invention of stenography among the Greeks is generally assigned to Xenophon the historian; but it is said that the art was first practised by Pythagoras, and that the poet Ennius was the first who adopted a system of short writing by which a person was enabled to follow a speaker. It is said, though upon no very certain testimony, that he commenced by employing eleven hundred marks of his own invention, and increased the number as circumstances required.

There are also writers who ascribe the invention of the art to Cicero; and it was certainly practised by him on account both of its brevity and secresy. He reminds (*Ad. Att.*, xiii. 32) his friend Atticus that he wrote (διὰ σημείων) by signs. The art was communicated by Cicero to Tiro, his freedman, who made considerable improvements in it, and is said to have been likewise the first person who applied it to the purpose of taking down public speeches. Eusebius attributes the invention to Tiro. The oration of Cato relative to the Catilinarian conspiracy, was preserved by means of shorthand. We are informed by Plutarch, in his 'Life of Cato' (c. 23), that on the occasion of delivering that speech, 'Cicero dispersed about the senate-house several expert writers whom he had taught to make certain figures, and who did, in little and short strokes, equivalent to words, pen down all he said.' The art was subsequently improved, and stenography became a fashionable accomplishment with the Romans. There is extant a work on the shorthand (*notæ* of the Romans) attributed to Tiro and Seneca, and printed in Gruter's 'Collection of Inscriptions.' Most of the writers of that age allude to the stenographic art in their works. Horace points out its brevity; and Ovid mentions its advantages in point of secresy. It is also commended by Ausonius, Martial, Manilius, and others. [NOTARY.] The Roman shorthand was very different from our own: the abbreviations, in general, appear to have resembled those adopted in ordinary writing, and which frequently occur in antient manuscripts, as well as in early editions of Latin works. A very large collection of MS. abbreviations is printed at the end of Göschen's edition of Gaius, and specimens of antient Roman stenography are given in Lewis's 'Historical Account of Shorthand.' Some passages in the Roman writers, which have been supposed to refer to shorthand, appear to refer to writing in cipher.

The first English treatise on Stenography was published in 1588, by Dr. Timothy Bright, and dedicated to Queen Elizabeth. It was entitled 'Characterie, or the Art of Short, Swift, and Secret Writing;' and consisted exclusively of arbitrary characters, each of which represented a word. Two years afterwards appeared 'The Writing Schoolmaster,' in three parts, by Peter Bale. This author remarks that 'Brachygraphy, or the art of writing as fast as a man speaketh treatably, may in appearance seem difficult, but it is in effect very easy, containing a many commodities under a few principles: the shortness whereof is attained by memory, the swiftness by practice, the sweetness by industry.' The system of Bale, like that of his predecessor Bright, was formed of arbitrary characters, instead of a combination of elementary marks or signs. Both systems were exceedingly crude, and difficult of attainment; requiring, as they did, for their practical application, a remarkable tenacity of memory; but they displayed great ingenuity as first attempts. The earliest effort to form a regular shorthand alphabet appears to have been made by John Willis, who, in 1602, published 'The Art of Stenographie, or Short Writing, by Spelling Characterie.' The work went through numerous editions. The alphabet was formed of the most difficult and complex characters, which were ill adapted for joining, their formation consuming treble the time required for forming the characters in any of the modern systems of moderate celebrity. Willis was followed by a host of imitators, none of whom however effected any material improvement. In 1618 appeared a treatise upon Stenography by Edmond Willis, which was followed in 1630 by that of Witt; in 1630 by that of Dix; and by a great number of others at short intervals; and, obscure as most of them were, they were ushered into the world with the utmost pomposity and eulogy. That of Rich, published in 1654, was praised by Locke. In 1753 was published the system of Mr. Thomas Gurney, which has since been so very extensively practised by various members of his family and others, in the houses of parliament, the courts of law, &c. Mr. Lewis, in his 'History of Shorthand,' observes, that it

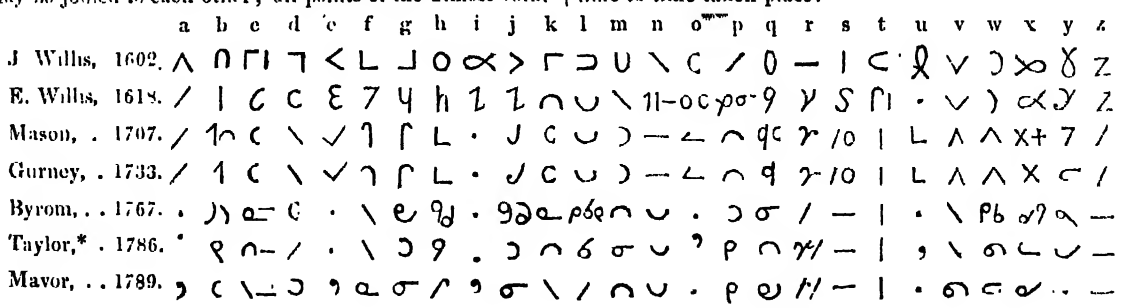
proves how the assiduous student of a bad system may outstrip the negligent pupil of a skilful master; as those by whom Gurney's system has been practised could only have attained eminence as shorthand writers by the exercise of the utmost diligence and perseverance.

Among the more recent systems, that of Dr. Byrom deservedly occupies a very prominent position. He succeeded in forming an alphabet at once simple, precise, and practicable, as well as in rendering the general details of his theory exceedingly clear and intelligible. His system was incomparably superior to any which had preceded it. Indeed Dr. Mavor (himself the author of a deservedly popular treatise on shorthand) observes, in the introduction to his own work, that 'it is above the reach of human ingenuity to exceed his (Dr. Byrom's) general plan, which must for ever be the basis of every future rational system.' Numerous other writers have also borne their testimony to the merit of Dr. Byrom's plan. Although the treatise was completed by the year 1720, it was not published till 1767, after the author's death, who, as he depended for support principally upon private tuition, obtained an act of parliament for the security of his invention. The doctor, in 1749, printed fifty copies of his work for the use of his particular friends. Since its publication it has been edited by several persons. Mr. Thomas Molineux, of Macclesfield, published an edition which he entitled 'An Introduction to Mr. Byrom's Universal English Shorthand.' It was popular for many years; but its circulation has latterly been much diminished owing to the numerous improved systems which have appeared. Many years after the appearance of Mr. Molineux's book, Mr. William Gawtress of Leeds, then one of the proprietors of the 'Leeds Intelligencer,' published a 'Practical Introduction to Shorthand' upon the general principles of Byrom. This unpretending volume is one of the cheapest and most useful manuals of shorthand which ever appeared. It contains many improvements on the original work.

The system next deserving of notice is that of Taylor, which made its appearance in 1786, and is entitled 'An Essay intended to establish a standard for a universal System of Stenography or Shorthand Writing.' This author's system is superior to that of Byrom in several particulars; but principally in a greater brevity and simplicity of the alphabet, and the facility with which the various characters may be joined to each other; all points of the utmost value and importance. Some useful practical improvements upon Taylor's system have been made in Mr. Harding's treatise on the art.

Dr. Mavor's system, though it obtained considerable popularity, is inferior to that of Taylor, on account of its alphabet requiring a greater number of strokes of the pen, and the characters being more difficult of junction. Since the publication of Dr. Mavor's treatise, many others of various degrees of excellence have been published, most of which are utterly destitute of merit. Those of Richardson and Clive are undoubtedly very ingenious, but they are too difficult of attainment to be generally useful. This is more especially the case with reference to the former. The author claimed for it the merit of enabling a person to write more in one hour than in an hour and a half by any other system before published. His principle is totally different from that of any other writer. He accomplishes his object by means of three horizontal and two perpendicular lines, which are placed at about the same distance from each other as the lines of the musical scale. These five lines furnish him (as he observes) with twenty distinct places or situations, which are called by the names of the different letters of his alphabet; and in writing by this system, the initial letter of every word is invariably omitted; the writer placing his pen on the place which represents that initial letter, from thence proceeds to write the second and subsequent letters of the word. The great exactness necessary in the formation and position of the characters must present an insurmountable obstacle to the general adoption of the system. Where however any person can practise it with the requisite facility, it is undoubtedly the best which ever was invented for the purpose of following a speaker. Mr. Clive's system is founded on a much more moderate application of the line principle than that of Richardson.

The foregoing remarks contain a brief history of stenography in this country; but there is scarcely a country in Europe which has not paid more or less attention to its cultivation. Those who desire further information as to the history of the art will find much valuable matter in Mr. Lewis's 'Historical Account of Shorthand.' The following alphabets will in some measure illustrate a portion of the foregoing remarks as to the improvements which have from time to time taken place:—



One experienced shorthand writer at least is now an indispensable auxiliary in the office of every well-conducted journal, and to shorthand writers we owe full reports of the proceedings of parliament, of public meetings, and of the courts of law. The newspaper press has given a powerful stimulus to the cultivation of the art, by affording a respectable livelihood to a numerous body of individuals. In addition to what it has done for the daily and weekly press in particular, shorthand is used for taking down sermons, scientific lectures, and public speeches both in parliament and at the bar. The publication, from the shorthand notes of Sir Henry Cavendish, a member of the 'Unreported Parliament,' as it is termed, which sat from 1768 to 1774, and from which strangers were excluded, is a valuable addition to the political history of the country, which we owe to the art of stenography. The shorthand notes written according to Gurney's system were found amongst the Egerton MSS.

By students of divinity, medicine, law, or others who may wish to preserve the whole or parts of discourses or lectures on scientific or other subjects, shorthand may be studied with great advantage. The art however is not to be acquired without the diligent application of many months, and it also requires considerable manual dexterity, though worthless treatises and travelling teachers of stenography occasionally assert the contrary. The pupil who is deluded in this manner, finding, after he has received the stipulated number of lessons, that he is unable to practise the art, distrusts either his own capabilities for learning, or the assertions of his teacher, and thus abandons the study of the art in despair or disgust.

We shall now give a brief summary of the principles of stenography, according to the system of Taylor, as improved by Harding.

Of the Alphabet.—The vowels are represented by points, a period standing for *a*, *e*, and *i*, and a comma for *o* and *u*. The single consonants of the shorthand alphabet amount only to sixteen, *c* and *z* being rejected as unnecessary, the former having both a hard and a soft sound, similar to *k* and *s*, as in the words 'command' and 'sentence;' *s* is therefore always substituted for *c*, where the letter has a soft sound, and *k* where it has a hard sound: *f* and *v*, being similar in sound, are both represented by the same character. For the same reason, *g* and *j* are represented by one character, as are also *k* and *q*. Characters are also assigned to double consonants, such as *ch*, *sh*, and *th*. These double consonants conduce to both perspicuity and expedition. The vowels are distinguished from each other by their position. For instance, should the period be placed over the top of a consonant, it signifies *a*; if placed against the side, or oppo

* As improved by Harding in the positions of the vowels.

site the centre of the consonant, it becomes *e*; if placed at the bottom, *i*. The personal pronoun *I* is represented by a mark similar to the top part of a note of admiration. The comma is *o* when placed in the same situation as the dot or period for *a*, and *u* when in the same situation as the dot for *e*. Where vowels have been generally omitted, either through the haste of transcribing remarks on any subject, or for expedition in following a speaker, they ought, where such a course is rendered necessary, to be supplied immediately afterwards, while the subject written is fresh in the recollection of the writer. In all words which have neither incipient, terminative, nor long vowels, no middle vowel should be expressed unless some peculiarity may render it expedient or necessary to deviate from this general rule. A word of more than one syllable, having a long vowel in it, must generally have that vowel expressed, because the long vowel being found in that syllable which is most distinctly heard in pronounciation, affords the greatest help in reading; at the same time, however, when a word of more than one syllable consists of several consonants, even the long vowel may be frequently omitted. The various characters of the alphabet represent, when placed by themselves, a number of small words. For example, the *a* or *an* is written by a dot; *the* and also *and* by a comma, the former being written above the line, and the latter below. The consonant b represents the word *be*, *by*, *been*: d, *do*, *did*, *done*: f, *off*, *of*, *if*; g, *God*, *give*, *go*, *good*; h, *have*, *he*; k, *know*, *known*; l, *Lord*, *all*, *will*, and so on throughout the alphabet. For the attainment of practical proficiency in the art, it is necessary that the alphabet should be acquired so perfectly as to be written correctly four times in a minute. It is necessary also in this place to explain that *d* and *r*, which in the alphabet appear to be precisely the same in form, are distinguished by the former, when joined to another consonant, being written downwards, and the latter upwards.

Of Prepositions and Terminations.—Prepositions and terminations are the letters or signs by which the first and last syllables of words are represented. The whole of the single and double consonants of the alphabet are employed in denoting the beginnings or endings of words; in which situations the letters are not joined to the other part of the word, but placed so close as to show their connection and prevent their being mistaken for separate and independent words. The letter *b* represents the prepositions *abs*, *obs*, &c.; and the terminations *ble*, *ible*, *bly*: the letter *d*, the prepositions *de* and *des*, and the terminations *dom*, *end*, *ened*, &c.: the letter *f*, the preposition *for* and the termination *ful*; and the other alphabetical characters are appropriated in a similar manner. Besides the consonants, several arbitrary marks are also used to denote the endings of words. In many cases a preposition and a termination together are all that are necessary to represent a word.

Of Arbitraries.—In the system of Taylor very few arbitraries are employed. They do not exceed twenty in number, and may generally be employed with advantage, which is more than can be said of the arbitraries of several other systems. The experienced shorthand writer may readily, and with much benefit to himself, increase the number of these marks as occasion may require. For instance, the individual who acquires the art of writing shorthand for the purpose of its practical application in a court of law, may readily assign arbitrary marks for such technical terms or lengthy words as are of most frequent recurrence. In the same manner the student of medicine or divinity may also form such characters to suit their own peculiar pursuits; and those persons who practise shorthand for a variety of purposes may in like manner adapt them to the several subjects on which they may have occasion to take notes. The great capabilities of arbitrary characters in these respects have not, we believe, been pointed out as they might have been, either by Mr. Harding or any other author into whose system we have looked.

Of the mode of Spelling.—The great aim of shorthand being to represent words by the fewest simple characters possible, all letters which are not distinctly sounded in any word must be omitted, except in cases where their retention may seem necessary. If words are written as they are pronounced, every silent letter will of course be omitted. In following a speaker however it is necessary that all vowels should be omitted, or otherwise it will be impossible to take more than the substance of his remarks. Where however proper names occur, they should either have the vowels inserted or be written in longhand: the latter method is most advantageous, as the names, when so written, serve as rallying-points to the eye in deciphering shorthand notes. Where the vowels are omitted in general writing, the rule is to write such of the consonants as are sounded in the pronounciation of any word.

Of Miscellaneous Modes of Abbreviation.—As in following a speaker all the vowels require to be omitted, and the consonants only written, so all the small words in a sentence are likewise left out. In some cases however, where the speaker is deliberate and the writer is expert, nearly all the words may be expressed. In the abridgement of sentences of course the writer is guided by his own judgment and the necessities of the case. The different tenses and moods of the verbs are generally expressed in the English language by the help of other verbs, as *shall*, *have*, *had*, *can*, *could*, *may*, *must*, *be*, &c. These being written by their first consonant, may be joined together; but a point should be inserted over the characters, to signify that they are the first letters of words in the sentence. The radical part of a word too may often be sufficient to denote the whole word, as *exp.* for expenses, *pos.* for possible, and so forth. A mode of contraction much used in common writing is to express the first and last consonants of a word, inserting a dash in the middle to show that it is deficient. This plan may be adopted in short-hand writing, or the common letters may be occasionally used. If the characters cannot be distinguished by the plan first pointed out, the termination may be written under the first consonant. The usual abbreviations in longhand can be adopted in shorthand. If a part of a sentence is to be repeated, a line may be drawn under it, and a caret placed where the repetition should be read.

As our object is not to supply a manual by which the art of shorthand may be acquired, but rather to afford some information concerning its leading principles, we have omitted explanations of minor importance.

STENOPS, Illiger's name for a genus of *Prosimii*, his third family of his second order, *Pollicata*, of *Mammalia* including the genera *Loris* and *Nycticebus* of Geoffroy.

Mr. Bennett, in his *Gardens and Menagerie of the Zoological Society*, observes that in an early memoir on the family to which the *Slow-paced Lemur* belongs, M. Geoffroy St. Hilaire divided it for the first time into those minor groups of which it was most obviously composed. But Mr. Bennett remarks that M. Geoffroy has since carried the principle of subdivision to a still greater extent by separating the slow-paced Lemur from the slender Loris, with which he had previously associated it, in order to form from it and some other doubtful species the genus *Nycticebus*. Mr. Bennett cannot perceive any sufficient grounds for thus disuniting two animals so intimately allied to each other, and differing in no more essential characters than the somewhat greater length of the nose and of the limbs in the one than in the other. For this reason Mr. Bennett prefers M. Geoffroy's older arrangement, and proceeds in accordance therewith to describe the Slow-paced Lemur as a species of *Loris*, which he considers to be a well-marked and circumscribed natural genus, differing from the Lemurs of the same author in many highly important characters. Mr. Bennett adds, that it is to be regretted that M. Geoffroy should not have applied the latter name to the species to which it was originally given by Linnæus, and to which alone it is, in Mr. Bennett's opinion, in any degree applicable, the Madagascar animals at present comprehended under it not presenting, he observes, even one of those characters on which Linnæus himself states that his generic name is founded.

'In common with the latter group,' says Mr. Bennett in continuation, 'the genus *Loris* forms part of that division of the Quadrumanous order which is essentially distinguished by an unequal number or irregular disposition of the incisor teeth in the two jaws; terminal nostrils with sinuous openings; and a long subulate or sickle-shaped claw upon the fore-finger of the hinder hands, all the rest of the nails being flat and rounded like those of the greater part of the monkeys and of man. The Loris differs from the other genera of this family in having four incisors in the upper jaw, placed in pairs with a vacant space between, and six in the lower, directed obliquely forwards; canines of moderate size; twelve molars above and ten below; a short rounded head and little or no tail. Sometimes, it would appear, the lateral incisors of the upper jaw, which

are always smaller than the others, are either entirely wanting or so minute as not to be easily seen. But M. Geoffroy was enabled to detect them in the identical specimen which Vosmaer had declared not to possess them: and it is by no means improbable that future investigators may ascertain their existence in the stuffed individuals sent from Java by M. Leschenhault, of which M. Geoffroy has made a new species, principally on account of the supposed absence of these teeth. In addition to these primary characters, the Loris are distinguished by large prominent eyes, placed in front of the head and at no great distance from each other; short ears, scarcely rising through the hair with which they are invested; a rough tongue; nostrils projecting beyond the mouth and surrounded by a naked muzzle; and thumbs widely separated from the fingers, both on the fore and hinder hands.'

The species included in the genus *Lemur* of Linnæus are *Lemur tardigradus, L. Mongoz, L. Macaco, L. Catta*, and *L. volans*. The locality assigned to *L. Mongoz, L. Macaco*, and *L. Catta*, is Madagascar.

Cuvier arranges under the *Makis* (*Lemur*, Linn.), '*Les Loris*, vulg. *Singes paresseux* (*Stenops*, Ill.) between the *Indris* [LICHANOTUS, Ill.] and *Galago* [OTOLICNUS, Ill.]. He states that the Loris have the teeth of the Makis, only that the points of the molars are sharper; a short muzzle (museau court d'un doguin); a slender body; no tail; great approximated eyes; and a rough tongue. Their nourishment, he says, consists of insects, small birds or quadrupeds, sometimes their progression is excessively slow, and their habits nocturnal. Sir Anthony Carlisle, he adds, found at the base of the arteries of the limbs, the same division into small branches as exists in the true sloths. To this part of their organization we shall presently allude more at large. Cuvier remarks, that two species are known, both from the East Indies—'*Le Loris paresseux, ou Le Paresseux de Bengale* (*Lemur tardigradus*, Linn.)' and '*Le Loris grèle* (*Lemur gracilis*);' the latter, he remarks, has the nose more raised by a projection of the intermaxillary bones, and upon this difference of the nose M. Geoffroy has made of the first-named species his genus *Nycticebus* and of the second his genus *Loris*.

M. F. Cuvier assigns the following dentition (that of the Great Galago)—Incisors $\frac{4}{6}$; canines, $\frac{2}{2}$; molars, $\frac{6-6}{5-5}$ = 36—to the small Galago, the Slender Loris, the Cingalese Loris, the Slow-paced Loris or Lemur, and the Dwarf Lemur, with hardly more than very slight exceptions, which are only manifested in the incisors and false molars.

The following are the generic characters of *Loris* and *Nycticebus*, Geoff.:—

Loris: four upper incisors; six lower incisors inclining forwards; head round, eyes very large, limbs very slender, no tail; four mammæ coming from two mammary glands only.* The tibia longer than the femur; ears short and hairy.

Dental Formula:—incisors $\frac{4}{6}$; canines $\frac{1-1}{1-1}$; molars $\frac{6-6}{5-5}$ = 36.

Species.—1, *Loris grèle, Loris gracilis*, Geoff.; *Le Loris*, Buff.; *Le Tardigradus*, Seba. 2, *Loris de Ceylan; Loris Ceylonicus*, Fisch.

The locality assigned to both these species is Ceylon; but, according to M. Lesson, neither Geoffroy, Desmarest, nor F. Cuvier admit the second species, regarding it as a simple variety differing hardly at all from *Loris gracilis*.

Nycticebus. Head round, muzzle short, eyes very large, ears short and hairy, a tail more or less long, extremities strong and robust.

Dental Formula:—Incisors $\frac{2 \text{ or } 4}{6}$; canines $\frac{1-1}{1-1}$; molars $\frac{6-6}{5-5}$; = 34 or 36.

Species, *Nycticebus Bengalensis; N. Javanicus;* and *N. Ceylonicus:* all from the East Indies.

We here adopt Mr. Bennett's view of the subject, and take the *Slender Loris* and the *Slow-paced Loris*, or *Slow-paced Lemur*, both of which are confounded by Linnæus under the name of *Lemur tardigradus*, as examples of the genus *Loris*.

* The glands, though apparently confluent, are actually distinct on each side, and agree in number with the mammæ.

We first notice *Loris gracilis*

Description.—Visage produced and dog-like, forehead high above the nose; ears large, thin, and rounded; body slender and weak; limbs very long and slender: thumb on each foot more distinct, and separate from the toes; on that and the three outmost toes are flat nails; on the interior toe of every foot a crooked claw; no tail: the hair on the body universally short and delicately soft; the colour on the upper part tawny, beneath whitish, space round the eyes dusky; on the head is a dark-shaped spot with the end pointing to the interval between the eyes. Length from the tip of the nose to the anus only eight inches.

Habits, &c.—Pennant, whose description we have given, states that notwithstanding the epithet (tardigradum) given in Seba, who has figured the animal (male and female) in the 35th plate of his first volume, the Slender Lemur is very active, ascending trees most nimbly, and having the actions of an ape. 'If,' says Pennant, 'we credit Seba, the male climbs the trees, and tastes the fruits before it presents them to its mate.' Seba himself observes that the epithet *tardigradum* is misapplied. Others say that it is a melancholy animal, silent and very slow, sleeping in the day and only awaking in the evening, and living on insects, fruits, and eggs.

Loris gracilis.

Loris tardigradus.—The most accurate description known to us is that given by Mr. Bennett, in the work above quoted, and which we here present to our readers in his own words.

'The Slow-paced Lemur is an animal of small size, scarcely equal to that of a cat. The largest individual yet noticed appears to be that seen by Pennant, who states its length at no less than sixteen inches from the nose to the extremity of its back. Its proportions are short and thickset; and the apparent clumsiness of its form is much increased by the manner in which it usually contracts itself into a kind of ball. Its head is broad, flat, and rounded, with a slightly projecting and pointed muzzle, in which the nostrils are perforated laterally. Its eyes are large and perfectly orbicular, and furnished with transverse pupils capable of being entirely closed during the day, and of being very largely dilated at night; their inner canthus is situated so low towards the nose that the motion of the eyelids appears to take place in a diagonal instead of a horizontal direction. The ears are short, round, widely open, but buried in the fur; and the tail is merely a rudiment of a few lines in length. The hinder limbs are considerably longer than the fore. The whole of the body, with the exception of the muzzle and hands, is thickly invested with long close woolly hair of a deep ashy grey with something of a brownish tinge. A deep brown or chestnut band passes along the middle line of the back, and is accompanied on either side by a faint greyish stripe, expanding on the back of the head into a still lighter patch. The dark middle stripe divides on the head into two branches, each of which is again subdivided, the posterior division passing transversely across the forehead and enclosing the ear, the anterior crossing the eye obliquely and extending to the angle of

the mouth. Between the two, above the outer angle of the eye, is a large white spot. Each of the eyes is surrounded by a ring of dusky black, between which a narrow white line passes from the back part of the head to the tip of the nose, which, with the exception of the naked muzzle, is also white. The latter, together with the naked parts of the hands, is of a livid flesh-colour with a tinge of black. On the under surface the fur is of a lighter grey than above.'

There are some parts of the *organization* of this animal that require more particular notice.

Sir Anthony Carlisle injected the arterial system of a *Lemur tardigradus*, and upon tracing the course of the vessels, so as to make a dried preparation, which is now in the Museum of the Royal College of Surgeons in London, he found that an unusual appearance of distribution was exhibited by the large trunks of the subclavian and external iliac arteries. He shows that immediately after the subclavian has penetrated the axilla, it is divided into twenty-three equal-sized cylinders, which surround the principal trunk of the artery, here diminished in size to an inconsiderable vessel. These cylindrical arteries, he observes, accompany each other, and divide with the ulnar and radial branches, being distributed in their route upon the muscles, each of which has one of these cylinders. The other branches, for example the radial and ulnar, proceed like the arteries in general, dispersing themselves upon the skin, the membranes, joints, bones, &c., in an arborescent form. The iliac artery, he tells us, divides upon the margin of the pelvis into upwards of twenty equal-sized cylinders, surrounding the main trunk, as described in the axillary artery: these vessels are also finally distributed as in the upper extremity; the cylinders wholly upon the muscles, and the arborescent branches on all the other parts. The cylindrical arteries, he adds, do not divide into equal-sized cylinders, but are distributed as in the generality of animals.

Sir Anthony concludes by observing that it would be of some importance in physiology to ascertain whether the other slow-moving quadrupeds have any peculiar arrangement of the arteries of those limbs. This solitary fact, he remarks is hardly sufficient for the foundation of any theoretical explanation of the slow movement of these muscles: if however it should be corroborated by similar circumstances in other animals, he thinks that a new light may be thrown upon muscular motion, by tracing a connection between the kind of action produced in a muscle, and the condition of its vascularity or supply of blood.

Mr Baird, in his interesting paper in the *Magazine of Nat. Hist.*, vol. i., 1829, remarks that all the known *Mammalia* close their eyelids in a direction upwards and downwards, and, in general, the upper eyelid is the one possessing the greatest degree of motion. He found however that in his slow-paced Lemur, the eyelids were brought together in a diagonal direction, or outwards and inwards, which gave the animal at the moment of shutting its eyes a most peculiar look. It was the under or outer eyelid that had the greatest degree of motion, the upper or inner one being almost fixed: and he concludes that the *orbicularis oculi* must be very powerful. After the death of the animal, and when Mr. Baird had left this country on a second voyage to India, the eye was dissected by Dr. Knox, who found that the peculiar movement of the eyelids above described did not depend on any peculiar structure, but merely on the greater degree of strength of the orbicularis muscle.

Mr. Baird also observed another peculiarity in the species. 'Beneath the tongue proper,' says he, 'if I may so call it, which is somewhat like that of the cat, though not rough, is another tongue, white-coloured, narrow, and very sharp-pointed, which he projects along with the other one when he eats or drinks, though he has the power of retaining it within his mouth at pleasure.' Mr. Baird however had not been able to see any particular purpose to which he applied it; but he saw him use this double tongue when eating flies, of which he was exceedingly fond, snapping them up most eagerly when presented to him, and catching them himself when they were reposing in the evening upon the walls of the room.

Habits, &c.—Little or nothing certain appears to be known of the habits of the Slow Lemur of Bengal in a state of nature, except as they may be inferred from those which it exhibits in captivity. In this latter state many good observers have narrowly watched it, and have recorded their observations.

Vosmaer received one in June, 1768, and kept it in his chamber. It slept all day to the evening, not waking (it being summer) till half-past eight. It was shut up in an oblong cage, secured with iron bars, and constantly slept sitting on its hinder parts close to the bars, with its head brought forwards between its fore-feet, which were bent against its belly. In this attitude it held on strongly to the wires with its hind feet, and often by one of the anterior feet as well, which induced Vosmaer to think that the animal ordinarily slept in trees attached to the branches. When awakened, it moved very slowly, and always the same from the commencement to the end, dragging itself from bar to bar, grasping one above with its fore-foot or rather hand, and not quitting its hold till it had slowly but very powerfully seized another with one of its anterior feet or hands. The same slowness marked its creeping on the ground, along which it dragged one foot after the other, as if it had been paralytic. In this mode of progression it raised its body but very little, so little, that as it dragged itself forward, the belly was frequently not more than the breadth of a finger from the ground. It was vain to attempt to drive it by putting a stick through the bars; for it would not quit its hold, and if pushed too roughly, its only defence was biting the stick. As the evening approached it awaked by degrees, like one whose sleep is broken after long watching. Its first care was to eat, for the day had been dedicated to repose. After its repast, which it despatched with comparative celerity, the remains of its former meal were evacuated. The fæces were in small pellets like sheep's dung, and the urine had a strong disagreeable odour. The sea-captain who brought it over, stated that it fed on rice boiled very thick, and that it had never been seen to drink.

Vosmaer, impressed with the belief that his animal would not refuse a different sort of food, gave it a leafy lime tree sprig: this it rejected. Fruits, such as pears and cherries, were more to its taste. It willingly ate dry bread and biscuit; but, if dipped in water, would touch neither. When offered water, it smelt it, but drank not. Eggs were favourite diet. 'Il aimoit à la fureur les œufs,' are the words of Vosmaer, who, concluding from its appetite for eggs that it would eat birds, gave it a live sparrow, which it instantly killed with a bite, and ate the whole very greedily. He gave it a live cockchafer, to try whether it would eat insects: it took the offering in its paw, and devoured it completely. Vosmaer afterwards gave it a chaffinch (pinçon), which it ate with much relish, and afterwards slept for the remainder of the day. He often saw it still awake at two hours past midnight; but from half-past six in the morning its sleep was so sound, that its cage might be cleaned without disturbance to its repose. If forcibly awaked during the day in order to teize it, it was vexed, and bit the stick; but with a very slow motion, repeating the cry *ai, ai, ai*, drawing out the *ai* each time into a plaintive, languid, and trembling note, in the same manner as is reported of the American sloths. When it was thus harassed for a long time, and thoroughly roused, it crawled two or three times round its cage, and then slept again.

The specimen observed by Sir William Jones was a male, as Vosmaer's appears to have been; and Sir William thus gracefully describes its habits:—'In his manners he was for the most part gentle, except in the cold season, when his temper seemed wholly changed; and his creator, who made him so sensible of cold, to which he must often have been exposed even in his native forests, gave him, probably for that reason, his thick fur, which we rarely see on animals in these tropical climates: to me, who not only constantly fed him, but bathed him twice a week in water accommodated to the seasons, and whom he clearly distinguished from others, he was at all times grateful: but when I disturbed him in winter, he was usually indignant, and seemed to reproach me with the uneasiness which he felt, though no possible precautions had been omitted to keep him in a proper degree of warmth. At all times he was pleased with being stroked on the head and throat, and frequently suffered me to touch his extremely sharp teeth; but at all times his temper was quick; and when he was unseasonably disturbed, he expressed a little resentment by an obscure murmur, like that of a squirrel, or a greater degree of displeasure by a peevish cry, especially in winter, when he was often as fierce, on being much importuned,

as any beast of the woods.' From half an hour after sunrise to half an hour before sunset he slept without intermission, rolled up like a hedgehog: and, as soon as he awoke, he began to prepare himself for the labours of *his* approaching day, licking and dressing himself like a cat, an operation which the flexibility of his neck and limbs enabled him to perform very completely: he was then ready for a slight breakfast, after which he commonly took a short nap; but when the sun was quite set, he recovered all his vivacity. His ordinary food was the sweet fruit of this country; plantains always, and mangoes during the season; but he refused peaches, and was not fond of mulberries, or even of guaiavas: milk he lapped eagerly, but was contented with plain water. In general he was not voracious, but never appeared satiated with grasshoppers, and passed the whole night, while the hot season lasted, in prowling for them: when a grasshopper, or any insect, alighted within his reach, his eyes, which he fixed on his prey, glowed with uncommon fire; and having drawn himself back, to spring on it with greater force, he seized his victim with both his fore-paws, but held it in one of them while he devoured it. For other purposes, and sometimes even for that of holding his food, he used all his paws, indifferently, as hands, and frequently grasped with one of them the higher part of his ample cage, while his three others were severally engaged at the bottom of it; but the posture of which he seemed fondest was to cling with all four of them to the upper wires, his body being inverted; and in the evening he usually stood erect for many minutes, playing on the wires with his fingers, and rapidly moving his body from side to side, as if he had found the utility of exercise in his unnatural state of confinement. A little before day-break, when my early hours gave me frequent opportunities of observing him, he seemed to solicit my attention; and if I presented my finger to him, he licked or nibbled it with great gentleness, but eagerly took fruit when I offered it, though he seldom ate much at his morning repast: when the *day brought back the night*, his eyes lost their lustre and strength, and he composed himself for a slumber of ten or eleven hours. . . . . My little friend was, upon the whole, very engaging; and when he was found lifeless in the same posture in which he would naturally have slept, I consoled myself with believing that he had died without pain, and lived with as much pleasure as he could have enjoyed in a state of captivity.'

Mr. Baird, in the paper above quoted, gives an account of one of these Loris (*loeris*, a clown, Dutch; name in Ceylon, according to that gentleman). Mr. Baird's specimen was a male, and was obtained at Pulo-Penang (Prince of Wales's Island). When Mr. Baird wrote, he had been in possession of the animal upwards of nine months. Its food consisted of fruit and small animals, such as birds and mice. The plantain was the fruit of which he was the most fond, and was the only food Mr. Baird saw him eat when he first got him into his possession. The necks of fresh-killed fowls formed the major part of its sustenance during the voyage. It was particularly fond of small birds: these, when put into his cage, he killed speedily, and, stripping off the feathers, soon devoured them, eating the bones as well as the flesh. Veal was preferred to all other butcher's meat, and it was fond of eggs; meat boiled, or otherwise cooked, it would not touch. Sugar appeared to be grateful to its palate, and it ate gum-arabic. 'As flesh is not always to be had quite fresh (the only state in which it is acceptable to him), he has for some time past been fed upon bread sopped in water, and sprinkled with sugar; this he eats readily, and seems to relish it much. M. Vosmaer mentions that his animal eat dry biscuit, but refused it if moistened with water; neither would it ever taste water. This is completely at variance with the habits of my animal, for he not only eats moistened bread, but laps water like a cat. When food is presented to him, if hungry, he seizes it with both hands, and, letting go with his right, holds it with his left all the time he is eating. Frequently, when feeding, he grasps the bars in the upper part of his cage with his hind paws and hangs inverted, appearing exceedingly intent upon the food he holds fast in the left hand. He is exceedingly fond of oranges;'—in this the animal resembled a domesticated *Lemur albifrons* once in our possession;—'but when they are at all hard, he seems very much puzzled how to extract the juice. I have, upon such an occasion, seen him lie all length upon his back, in the bottom of his cage, and, grasping the piece of orange with both hands, squeeze the juice into his mouth.' Mr. Baird, after noticing the cry mentioned by Vosmaer and Sir W. Jones, says, 'When the cat annoys him, which she does very frequently by leaping over him, he repeats the cry nearly a dozen times: it is always however expressive of anger. He has also another sort of cry expressive of eagerness to obtain anything: this is much gruffer in sound, not shrill nor loud, but apparently made by forcing the air out of his nostrils. He likes much to be stroked under the chin and throat, and also under the arms, turning his head round to the hand like a cat, and lifting his arm, stretching it out beyond his head. Though not a very sensible animal, he is still evidently capable of feeling kindness and showing resentment. He allows his throat and fore-arms to be stroked, but refuses to let the same liberty be taken with his lower limbs. For some time while in China, a little Chinese dog was his companion, sleeping in the same cage with him; and, with the exception of a few occasional jars, they lived very comfortably together. As the dog grew up however they were separated. A cat, the only animal in the house besides himself, has made many overtures to him, and when he is allowed to get out of his cage, he is followed up and down the room by his feline companion, who evidently wishes to make him her playfellow. Any undue familiarities however on her part are met with an immediate repulse from him; and, one time, when patting him rather incautiously with her foot, he bit her so severely, that she now, though evidently wishing to be on good terms with him, keeps at a safe distance. This same cat has, since this, become more familiar. Though not daring to approach him, she follows him wherever he goes, to his great annoyance, and renders herself an object of his abhorrence. He cries out on her approach, and is sadly tantalised by her playful trick of leaping over him. He seems to be rather a social animal notwithstanding. A large japanned tray attracts a good deal of his attention. Seeing his image reflected in it, he walks before it, and tries to grasp his own image. Finding his efforts ineffectual, he imitates the action of the child, by peeping behind it, with expectation to see the object there. Before a looking-glass he shows the same regard and curiosity.' In most respects, the rest of Mr. Baird's description agrees with those of Vosmaer and Sir W. Jones.

M. d'Obsonville's memoir is very interesting, but offers no differences sufficient to justify the insertion of his account of his specimen at length. The little animal, which enjoyed comparative liberty, being suffered to go at large, appeared to him to be very much attached. He used to caress it after giving it food; and the marks of sensibility upon the part of his favourite were, taking the end of his hand and pressing it to its bosom, fixing, at the same time, its half opened eyes upon his.

One that Pennant saw in London, slept holding fast to the wires of its cage with its claws, as above described, and he states that the inhabitants of Bengal call the animal *Chirmundi Billi*, or *Bashful Billy*. Sir W. Jones says of it, 'The Pandits know little or nothing of the animal: the lower Hindus of this province generally call it Lajjábánar, or the Bashful Ape; and the Mussulmans, retaining the sense of the epithet, give it the absurd appellation of a cat; but it is neither a cat nor bashful; for though a Pandit, who saw my Lemur by day-light, remarked that he was *Lajjálu*, or modest (a word which the Hindus apply to all sensitive plants), yet he only seemed bashful, while in fact he was dimsighted and drowsy; for at night, as you perceive by his figure, he had open eyes, and as much boldness as any of the *Lemures* poetical or Linnean.'

In a state of nature there can be no doubt that its habits are, for the most part, arboreal; and that it takes its prey by night, seizing that which is living, such as small birds, mice, and insects, by surprise, probably whilst they are sleeping; and varying its diet by having recourse to fruits.

Localities.—'As to his country,' says the author last quoted, 'the first of the species that I saw in India was in the district of Tipra, properly Tripura, whither it had been brought, like mine, from the Garrow Mountains; and Dr. Anderson informs me that it is found in the woods on the coast of Coromandel: another has been sent to a member of our society from one of the eastern isles; and though the Loris may be a native of Silán, yet I cannot agree with M. de Buffon that it is the minute, sociable, and docile animal mentioned by Thevenot, which it resembles neither in size nor disposition.'

It has been found in other parts of the peninsula of Hindustan; and in Java, Penang, and Ceylon.

Loris tardigradus.

STE'NOPUS. [SHRIMPS, vol. xxi., p. 425.]

STENORHYNCHUS. [SEALS, vol. xxi., p. 163.]

STEPHANO'MIA. [PHYSOGRADA, vol. xviii., p. 138.]

STE'PHANUS ATHENIENSIS (Στέφανος Ἀθηναῖος), an antient Greek physician, the author of several treatises still extant. Nothing is known of the events of his life, except that (if we may believe the titles of some manuscripts at Vienna) he was a pupil of Theophilus Protospatharius. (Lambec., *Biblioth. Vindob.*, lib. vi., p. 198, 223, 492; lib. vii., p. 352, ed. Kollar.) Neither is it known for certain when he lived, for his having Theophilus for his tutor does not at all help to decide this question, as it is equally difficult to determine the date of the master as of the pupil. G. J. Vossius (*Lib. de Philosoph.*, cap. 13, p. 109, in *Opera*, tom. iii., ed Amst.) and Fabricius (*Biblioth. Gr.*, tom. xii., p. 693) think he is the same as the author who is known by the name of *Stephanus Alexandrinus*, and who dedicated his work *De Chrysopoeia* to the emperor Heraclius (A.D. 610-641); and that he might have been called *Atheniensis* from having been born at Athens, and *Alexandrinus* from having settled at Alexandria. Probably however neither of these great scholars ever saw his works in the original; as Dietz, his editor, notices several words that occur in them, which seem to belong to the eleventh century rather than the seventh (*e.g.* Ψυχία ἄφρατα, *Comment in Hippocr.* '*Prognost.*,' p. 87; τζίμβλοι, *ibid.*, p. 89; λαγωδάτον κοιμᾶσθαι, p. 94; μάγκιπες, p. 146; ἀκατίδες, p. 154; κλοκίον, p. 159). The first of his works that we possess is a Commentary on the '*Prognostics*' of Hippocrates, which was first published by Dietz (who calls him 'inter Hippocratis interpretes sequioris aetatis facile princeps'), in the first volume of his *Scholia in Hippocratem et Galenum*, Regim. Pruss., 1834. There is also a commentary on the 'Aphorisms' which bears his name, and which in fact agrees word for word with that which is commonly attributed to Theophilus. Some extracts from this are inserted in the second volume of Dietz's collection. His commentary on Galen's *Ad Glauconem de Medendi Methodo*, is said by Fabricius and Choulant (*Handb. der Bücherkunde für die Aeltere Medicin*, Leipzig, 1841) to have been first published at Venice in Greek by Aldus, 1536, 8vo.; but Dietz doubts the existence of this edition. He has himself inserted the commentary in the first volume of his collection mentioned above. It had before appeared several times in a Latin translation by Augustinus Gadaldinus, Venet., 1554, 8vo., Lugd., 1555 and 1558, 8vo. Another of his works was published in a Latin translation by Casp. Wolf, with the title *Alphabetum Empiricum, sive Dioscoridis et Stephani Atheniensis de Remediis Expertis Liber, &c.*, Tiguri, 1581, 8vo. The treatise on fevers, sometimes attributed to Stephanus Atheniensis, is in fact by Palladius. [PALLADIUS, vol. xvii., p. 170.]

The work on Alchemy by Stephanus Alexandrinus consists of nine πράξεις, or *Lectures* (see Fabricius, *Biblioth. Gr.*, tom. xii., p. 695), with the title Στεφάνου Ἀλεξανδρέως, Οἰκουμενικοῦ Φιλοσόφου καὶ Διδασκάλου, Μεγάλης καὶ Ἱερᾶς ταύτης Τέχνης περὶ Χρυσοποιίας Πρᾶξις ἐν Θεῷ πρώτη. It was published in Latin, Patav., 1573, 8vo., by Dominic Pizimentus, together with Democritus, Synesius, and other writers on the same subject. The writer was a Christian, and lived (as was before noticed) in the seventh century. Reinesius (ap. Fabric., *Bibl. Gr.*, tom. xii., p. 757) speaks highly of his work, but notices that he falls into the common error of the Eastern and Greek churches of that age respecting the procession of the Holy Ghost. This was one of the works which Dietz was preparing to edit at the time of his death. (See *Schol. in Hippocr. et Gal.*, Praefat., p. xix.)

It may be mentioned that the father of Alexander Trallianus (Alex. Trall., *De Re Med.*, lib. iv., cap. 1, p. 230, ed. Guint.), and a physician of Edessa, sent by Justinian as ambassador to the Persian king (Procop., *De Bello Pers.*, lib. ii., cap. 26) must not be confounded with the two writers noticed in this article, both of whom probably lived much later.

STE'PHANUS BYZANTI'NUS, a Greek grammarian, the author of a geographical dictionary, the earliest probably ever written. Nothing is known of his life, and his age is uncertain; he is placed by Saxius (*Onomasticon*, i., 520) in the latter part of the fifth century. Of his original work nothing but an abridgement made by Hermolaus, another grammarian, who lived in the time of the emperor Justinian, has come down to us, with the exception of a fragment of the letter Δ beginning with Dyme and ending with Dodona, which was first published from the 'Bibliotheca' of Peter Seguier, by Samuel Tennulius, Amstel., 1669, 4to. A comparison of this portion of the original work with its abridgement will show how much valuable matter has been omitted by Hermolaus. Constantine Porphyrogennetus, in his book 'De Administrando Imperio,' c. 23, 24, and in that on the Themata (lib. 2, *Thema* 6, 9, 10, 12), quotes from Stephanus and gives much fuller extracts than are found in the 'Epitome,' and in one instance cites him by name (*Thema* 9, 'De Sicilia;' see 'Excerpta Constantini Peiresciana,' edit. Henr. Valesius, p. 493; and also *Etymolog. Magnum*, voc. Σφήκεια). In the work, as it has come down to us, much of the letter K, from KE to KO, is wanting, which is known to have existed, according to Scaliger, quoted by Fabricius (*Biblioth Graec.*, iii. 51, Hamburg, 1717). The latter part is less full than the earlier; from Patræ to Σ little more than the names of places and their adjectives are given; from this letter onwards the extracts become less meagre. In X and Ω we have what, from the difference in style, may be considered an uncurtailed transcript of the original; the first nine articles of X are abridged in the 'Codex Vratisl.,' like those of the preceding letters, as if the epitomist had desisted suddenly in his undertaking. The difficulty of distinguishing the original material from the possible additions of Hermolaus prevents us from relying with any certainty on several passages in the work which have been thought to refer to Stephanus himself. Under the word Ἀνακτόριον, he or his abridger speaks of Eugenius, a grammarian (according to Suidas) of the time of the emperor Anastasius; in the article Γότθοι occur the words, 'as has been said by me in the Byzantica;' and under Βήτλεμα (Bethlehem) are expressions, which prove the writer of them to have been a Christian. Westermann, in the preface to his edition of Stephanus (Lips., 1839, 8vo.), is inclined to apply these passages to him rather than to Hermolaus, and his reasons are apparently just. In the Burney MS. 50, 11, 254, British Museum, in a volume entitled 'Vitæ, Mores, et Dicta Patrum Sanctorum, Ordine Alphabetico disposita, ex Johannis Moschæ Prato Spirituali aliisque Auctoribus collecta,' is mention of a Stephanus of Byzantium, who is described as one of the scribes or chartularii of Maurianus the General; his great fame is spoken of, and a miraculous scene at his death is described, at which the narrator and Theodosius, bishop of Babylon, are said to have been present. A Count Maurianus lived in the time of the emperor Zeno, A.D. 490 (*Chron. Paschal.*, 261; *Corpus Byzant. Script.*, Venet., 1729); and another was Comes Domesticorum in the time of Honorius (Banduri, *Comment. in Antiq. C. P.*, lib. ii., 477, ibid.), and it is possible that some future discovery may connect the Stephanus mentioned in this passage with the subject of this biography.

Westermann has adopted the title Ethnica (Ἐθνικά), on the authority of Eustathius, instead of that of Περὶ Πόλεων, prefixed to the work by Aldus and others. The editions of Stephanus are, Aldi Manutii, Venet., 1502, fol.; Flo-

rent. ex Juntar. officin., 1521, fol.; Gesner, Basil., 1553 fol; Xylander, Basil., 1568, fol., cum castigat.; Thomas de Pinedo, Amstel., 1678, with a Latin translation and useful commentary, and the fragment published by Tennulius. Luc. Holsten., Lugd. Batav., 1684, with many annotations; Abraham Berkel, Lugd. Batav., 1688, fol. This edition was finished by Gronovius, 1694, who republished the fragment with a triple Latin translation in the 7th vol. of the 'Thesaurus Antiq. Græc.' (See Saxii *Onomas.*, and Fabricius, as cited above; also the edition of the latter, Helmstadt, 1774, for some additional remarks.)

The work of Stephanus contains many interesting particulars relative to history and mythology; it treats of towns, nations, and tribes, giving to each proper name its gentilitial adjective. It does not however appear, as some have supposed, that the chief object of the author was to convey grammatical information, and a title to the work, written at the end of the fragment already mentioned, and quoted as proving this, is not considered genuine. The number of authors cited in the fragment makes us the more regret the loss of so valuable a compilation as the whole work must have been. The notices of cities in the 'Epitome,' particularly of those which struck coins, are very useful in the illustration of the local history and topography of the antient world.

STEPHEN, the first Christian martyr, has been supposed, on no very sufficient grounds, to have been one of the 'seventy-two disciples.' It is more likely that he was an Hellenistic Jew, and one of the large body converted on the day of Pentecost by the preaching of St. Peter. He appears to have been a person of some reputation, and was one of the seven deacons chosen to attend to the temporal affairs of the growing church. The Jews, from the different synagogues out of Palestine, exasperated by the defection from their body of so eminent a person as Stephen, lost no opportunity of contending vehemently with him, and ultimately brought him before the Sanhedrim, to give an account of his belief and conduct. In answer, he commenced a fine oration, the object of which appears to have been to open, historically, the true design of the Jewish dispensation, and the consummation of that design in Christ. The object of this discourse has however been disputed; and it was, in fact, not fully developed by the speaker, as he was interrupted by the clamours of the mob, who 'were cut to the heart, and gnashed on him with their teeth.' He was however encouraged by a vision of 'heaven opened,' and of Christ glorified; on declaring which to the people, they rushed upon him, dragged him outside the city, and there stoned him to death, A.D. 33. With his last breath he invoked the pardon of God for his murderers. This was entirely an extrajudicial act, the effect of popular excitement; for the Sanhedrim did not convict him, and had indeed no power to inflict death.

STEPHEN I. was elected bishop of Rome after the death of Lucius, A.D. 253. He was applied to by the Christians of Gaul concerning some differences which they had with Martianus of Arles, who appears to have been unusually austere in matters of discipline. Next came the commotions among the Christians of Spain concerning the two bishops Basilides and Martialis, who were both deposed. Basilides went to Rome, and, it appears, prevailed upon Stephen to take his part; but the Spanish bishops applied to Cyprian of Carthage, who approved of the deposition of Basilides, and caused it to be confirmed by a council held in Africa. A controversy arose between Stephen and Cyprian concerning the baptism of heretics, but the authenticity of the letters of Cyprian and Firmilian concerning this dispute has been disputed by some church historians and critics. Stephen died A.D. 257, but the manner of his death is not clearly ascertained: the 'Acta S. Stephani' are not considered as genuine. Of Stephen's writings we have only fragments of epistles. (Dupin; Walch; Mosheim; Ceillier.)

STEPHEN II. was elected after Zacharias (A.D. 752), but died three days after his election, without being consecrated, for which reason he is generally omitted in the series of the popes.

STEPHEN III., a native of Rome, was elected the successor of Stephen II., and he is styled by many Stephen II. Astolphus, king of the Longobards, having shortly before driven the Byzantines out of Ravenna, and the Exarchate, and Pentapolis, marched towards Rome, in violation of the peace concluded between his predecessors and that see, and having advanced as far as Narni, sent messengers to the pope, requiring the inhabitants of Rome and its duchy to pay him a capitation tax, and acknowledge him for their liege lord, threatening to pillage Rome in case of refusal. Stephen, having applied in vain for assistance to the Eastern emperor Constantine Copronymus, who was at that time busy in breaking images and persecuting image worshippers, had recourse to Pepin, king of the Franks, whose accession to that throne in lieu of the deposed Childeric, the last nominal king of the Merovingian dynasty, had been countenanced and sanctioned by Zacharias, Stephen's predecessor. Pepin sent two legates, to endeavour to prevail upon Astolphus to desist from annoying the pope. Their remonstrations proving useless, pope Stephen determined to repair to France in company with Pepin's legates. Pepin received the pope with the greatest respect, and was crowned and anointed by him in the church of St. Denis, together with his two sons Charles and Carlomann. It was then agreed between Stephen and Pepin that Pepin should oblige Astolphus to evacuate not only the duchy of Rome, but also the Exarchate and Pentapolis, which he had taken from the Byzantines, and that those territories should be made over to St. Peter and the Roman see. Pepin, accompanied by Stephen, marched with an army into Italy, defeated Astolphus, besieged him in Pavia, and obliged him to promise to give up Ravenna with the Exarchate, which embraced the actual provinces called the Papal Legations, and the Pentapolis or present March of Ancona, including Urbino and Pesaro. Astolphus made the promise, and gave hostages to Pepin, who quickly returned to France (A.D. 754). In the following year however, Astolphus, having recruited his forces, marched straight to Rome, to which he laid siege, devastating the country around. Pope Stephen now wrote to Pepin in the most urgent manner, in the name of St. Peter: 'Petrus vocatus Apostolus à Jesu Christo Dei vivi filio: Viris excellentissimis Pipino, Carlo et Carolomanno tribus regibus,' &c., promising them and all the French people eternal life, if they would support the rights of St. Peter's see, but threatening them with eternal perdition if they neglected so to do. These remarkable letters of pope Stephen are in Baronius, Duchesne, and the Codex Carolinus. Pepin quickly repaired to Italy, again defeated Astolphus, who had been obliged to raise the siege of Rome in order to oppose him, and besieged him in Pavia. While Pepin was encamped before that city, an envoy appeared before him, sent by Constantine Copronymus, emperor of the East, who, after praising Pepin for having driven the Longobards out of the Exarchate, demanded its restitution to its former sovereign the emperor. Pepin replied that the Exarchate had belonged to the Longobards by right of conquest, and also by the will of the people, who had given themselves up to king Luitprand, in consequence of the persecution of the images ordered by the Greek emperors; and that now by the same right those provinces belonged to Pepin, who had taken them from the Longobards, and that he had thought it expedient to give them to the pope for the honour and advancement of the Catholic church, and to keep it free both from the heresies of the Greeks and from the ambition and rapacity of the Longobards. (Anastasius *in Vita Stephani III.*) Pepin, having dismissed the envoy with this answer, continued to press the siege of Pavia, and Astolphus was obliged to sue for peace. Pepin required him immediately to deliver to his commissioner Fulrad, abbot of St. Denis, the towns of the Exarchate and Pentapolis, and to cause them to be evacuated by the Longobards. This being done, Fulrad carried the keys of those towns to Rome, and deposited them on the sepulchre of the holy Apostle, together with the solemn deed of donation signed by Pepin, his two sons, and the principal barons and prelates of France. This act of donation is lost, but from some of the expressions, gathered from pope Stephen's letters, it appears that it was made to the blessed Peter, and the holy church of God, and 'to the Roman republic.' The city and duchy of Rome were therefore not included in the donation, as they had not been conquered either by the Longobards or by Pepin. The pope then entrusted the administration of the Exarchate to the archbishop of Ravenna. Some critics, especially French, and Sigonius himself, assume that Pepin gave to the pope only the 'utile dominium' of the Exarchate and Pentapolis, and retained for himself and his successors the 'jus imperii,' or sovereign rights.

Soon after this memorable transaction Astolphus died of an accident while hunting, and Desiderius, king of Tuscany,

was chosen by the Longobards for their king. Ratchis, brother of Astolphus who had formerly abdicated the crown and turned monk, left his convent and aspired again to the throne. Desiderius applied to pope Stephen, who ordered Ratchis to return to his convent. Ratchis obeyed, and Desiderius was acknowledged king. In the following year (April, 757) pope Stephen died, and was succeeded by Paul I. We have of pope Stephen's writings, besides his letters in the Codex Carolinus, his 'Responsa ad Gallos,' in Harduin's 'Concilia.'

STEPHEN IV., styled III. by some, a Sicilian by birth, was elected pope A.D. 768, more than a year after the death of Paul I., during which time one Constantine, a layman, and brother of Toto, duke of Nepi, intruded himself by force on the papal see, having obliged Gregory, bishop of Praeneste, to ordain and consecrate him. At last part of the Roman clergy, supported by the Longobard duke of Spoleto, who sent an armed force to Rome, overcame the faction of Constantine, who was deposed, deprived of his eyes, and shut up in a convent, and Stephen was elected. The new pope convoked a council in the Lateran, in which all the abettors of Constantine were degraded. Shortly after, new disturbances broke out in Rome, which induced Desiderius, king of the Longobards, to go thither with some troops. He had several interviews with pope Stephen in the Vatican Basilica outside of the walls, and assisted him in quelling the insurrection, the leaders of which had their eyes put out.

King Pepin being dead, the kingdom of the Franks was divided between his two sons, Charles and Carlomann. Bertha, Pepin's widow, having made a journey into Italy, saw king Desiderius, and arranged with him a matrimonial alliance between two of his daughters and her two sons. Pope Stephen, upon hearing this, wrote to the two kings of the Franks a very violent letter, which is contained in the Codex Carolinus, dissuading them from the proposed alliance, and asserting that it would be 'arrant folly to contaminate their noble legal race with the perfidious and infected race of the Longobards, who had brought leprosy into Italy, and who did not deserve to be reckoned among nations; that having promised to St. Peter to be friends of his friends, and enemies to his enemies, they ought to shun the alliance of the Longobards, who were enemies to Rome,' adding several scriptural passages which he made to bear upon the subject: he concluded by stating that he wrote this letter upon the sepulchre of the holy Apostle, and he threatened them with excommunication if they spurned his advice. The alliance however took place, at least in part; for Charles (afterwards Charlemagne) married Hermengarda, daughter of Desiderius, whom he repudiated a year after, to marry Hildegard, a German princess.

Sergius, archbishop of Ravenna, being dead, the archdeacon Leo was elected his successor; but Mauritius, duke of Rimini, went to Ravenna with an armed force, and violently placed in the archiepiscopal see the archivist Michael, a layman. Pope Stephen refused to consecrate Michael, who, after having stripped the church and treasury of many valuables, at last retired, and made room for Leo. It is said that king Desiderius favoured Michael. Pope Stephen, in the latter part of his pontificate, was at open variance with the king of the Longobards, who kept or recovered possession of Ferrara, Comacchio, and Faenza, which formed part of the long-disputed Exarchate. Pope Stephen died at the beginning of A. D. 772, and was succeeded by Adrian I.

STEPHEN V., a native of Rome, succeeded Leo III., A.D. 816. Shortly after his consecration he went to France to confer with the emperor Louis the Pious, whom he met at Orleans, and who received him with great honour. On his return to Rome, he died in the seventh month of his pontificate. He founded at Rome the monastery of Santa Prassede, which he gave to a congregation of Greek monks, who retained their own liturgy.

STEPHEN VI., a Roman, succeeded Adrian III. in the year 885. He found, on his accession, the Lateran palace stripped of its treasures and other valuables by the relatives and attendants of the late pope, according to the practice of those times. The public granaries were also empty, and the people of Rome were suffering from famine resulting from a bad harvest and from swarms of locusts which had desolated the country. Stephen ordered the fields to be sprinkled with holy water; but at the same time he promised a bounty in money for every measure of dead locusts which the peasants should bring him, and this had the effect of clearing the country of that scourge. He also sold his own property to relieve the poor. Pope Stephen had been consecrated by John, bishop of Pavia, who was one of the Imperial 'missi;' but the emperor Charles the Fat was angry because the new pope had not waited for his approbation, and he sent some of his officers to Rome to arrest him, but Stephen having forwarded the report of his election, made according to the canonical forms, and numerous attestations of both clergy and laity, the emperor was pacified. In the year 887 Charles the Fat was deposed, and his vast monarchy parcelled out. Berengarius, duke of Friuli, was elected by a part of the Italian barons king of Italy; but he found a rival in Guy, duke of Spoleto, who overthrew Berengarius in battle, and was crowned at Rome by the pope, in February, 891, with the title of emperor, 'Wido Imperator Augustus.' Soon after this solemnity pope Stephen died, and was succeeded by Formosus. Pope Stephen is said by Gulielmus Bibliothecarius to have been a man of learning: he collected manuscripts, which he gave to the Basilica of St. Paul.

STEPHEN VII., bishop of Anagni, and a native of Rome, succeeded (A.D. 896) Benedict VI., who had not lived a month after his election, which took place on the death of Formosus. Stephen, from what motive is not clearly ascertained, persecuted with the greatest bitterness the memory of pope Formosus, caused his body to be disinterred and stripped of its pontifical garments, and thrown into a common grave among laymen. He justified himself by the fact that Formosus, before his elevation to the papacy, had been excommunicated by pope John VIII., in consequence of the frequent factious strifes which often broke out at Rome. Stephen also annulled all the acts and decrees of Formosus. This affair of Formosus gave rise to much controversy, which lasted during several successive pontificates; and a contemporary writer called Auxilius wrote in defence of the memory of Formosus, 'De Ordinatione Formosi Libri Duo.' In the year 897 an insurrection of the friends of Formosus broke out at Rome, and pope Stephen was seized, cast into prison, and strangled. He was succeeded by Romanus, who annulled all Stephen's acts as to Formosus.

STEPHEN VIII. succeeded Leo VI., A.D. 928. This was the period when Marozia, and her husband Guido, duke of Tuscany, ruled in Rome. They had put to death pope John X., and are said to have done the same to his successor Leo VI., whose pontificate lasted only seven months. The election of Stephen is supposed therefore to have been effected with their approbation; but we have no historical record concerning the particulars of his pontificate. The tenth century is the truly dark age of Italian history. Stephen VIII., styled by some VII., died in December, 930, and was succeeded by John XI., son of Marozia.

STEPHEN IX. succeeded Leo VII., A.D. 939. Rome was then governed by Alberic, son of Marozia, who assumed the title of 'prince and senator of all the Romans.' Little or nothing is known of Stephen IX.'s pontificate. Martinus Polonus alone, a chronicler of dubious authority, says he was roughly handled by the Romans in a popular tumult, and was crippled for the rest of his life. He died A.D. 942, and was succeeded by Martinus III.

STEPHEN X., styled IX. by some, Cardinal Frederic, abbot of Monte Casino, and brother of Godfrey, duke of Tuscany, succeeded Victor II., A.D. 1057. He had been legate of Leo. IX. to the court of Constantinople, and was learned in controversial divinity. His election is said to have been unanimous. By the advice of the monk Hildebrand (afterwards Gregory VII.), he sent two legates to Milan to enforce the decrees concerning the celibacy of the clergy, which the church of Milan had not yet adopted. This dispute had begun in 1021, at the council of Pavia, and it lasted for nearly half a century. Stephen issued also several bulls against simony, which was prevalent in his time. He sent for the learned Petrus Damianus, who had retired to a secluded cloister, and obliged him to come to Rome under pain of excommunication, and made him cardinal and bishop of Ostia. The pope also visited his former monastery of Monte Casino, in which he enforced a strict discipline. He also issued a bull exempting the clergy from the jurisdiction of the lay courts, and from paying tribute to laymen. From some passages of Leo Ostiensis and other chroniclers it has been surmised that he intended to make his brother Godfrey king of Italy. But the pope fell ill,

and died at the beginning of 1058. On his deathbed he recommended the clergy and people to wait for the return of Hildebrand from Germany before they elected his successor, but the advice was not followed, and a schism ensued. [BENEDICT X.; NICHOLAS II.]

STEPHEN, ST., first king of Hungary, son of the Magyar chief Geysa, and Sarolta, the daughter of Gyula, a Hungarian nobleman who had been baptized in Greece, was born about 979, at Gran (*Estragan*, the antient Strigonium).

His father Geysa (Gyözö, *i.e.* Victor), whose fierce and indomitable character the Christian Sarolta had succeeded in softening, allowed Piligrin, bishop of Lorch, to preach the gospel to the Magyars; but these first attempts proved unsuccessful, and it was only at a subsequent period, when Geysa himself was converted, that a few of his countrymen followed his example. The number was however greatly increased upon the arrival in Hungary of St. Adalbert, who advised Geysa to allow Christians to settle there; and in consequence of this permission being granted, a number of Germans and Italians established themselves in the neighbourhood of the capital, Gran. The majority of the Hungarians being however still attached to their gods, persecution as well as other means of conversion were used against them. In the midst of preparations for a powerful attack against his heathen countrymen Geysa died, and Stephen succeeded him in 997.

The legend says that an angel had announced to Geysa the birth of a son, and that St. Stephen, the protomartyr, appeared to Sarolta, and bade her call her offspring after him. The name which he bore before his baptism was Vâik, according to Mailath. Great care was taken by his mother that he should receive a good education; Count Deodatus à San Severino, in Apulia, was appointed his instructor, and St. Adalbert, of Prague, baptized him in 995. Shortly after this he married Gisela, the sister of the emperor Otho III.

The dissatisfied Magyars, though they had hitherto refrained from any acts of violence against the Christians, who enjoyed the powerful protection of Geysa, now began to make open resistance. The youthful inexperience of Stephen, who had scarcely assumed the reins of government, seemed to give them hopes of succeeding in their attempts to check the progress of Christianity and restore their antient religion. Indeed it appears that when Kupan, the count of Simegh, had consented to lead the heathen Magyars, a number of those who had received Christian baptism joined his standard. In addition to this, so wavering was the faith of those who remained with Stephen, that the youthful chief could only rely upon the support of the foreigners. Kupan had assembled all his forces, and marched towards Weszprim, in the neighbourhood of which town Stephen met him. After a desperate battle, in which Kupan lost his life, the victory so decidedly leaned towards the side of the Christians, that the few remaining adherents of the party of Kupan quitted it. For the purpose of securing the possession of his throne, Stephen sent an embassy to Pope Sylvester II., at the head of which was Astricus or Anasbasius, bishop of the newly erected see of Kolotz, who was instructed to obtain the title of king for Stephen. Astricus soon returned with a crown and a deed of the pope, which gave Stephen unlimited power in the ecclesiastical affairs of his country. The coronation took place on the 15th of August, 1000. From the time of his assuming the title of king, the peaceful occupations of Stephen were only interrupted by a few warlike incursions, all of which he successfully repelled.

In 1002 Gyula, his cousin, rebelled against him, and publicly abjured Christianity. After a short campaign he was taken prisoner with his two sons, and Zóltan was appointed governor of Transylvania in his stead. The Bulgarians having assisted Gyula in his rebellion, and threatening to make an incursion into the kingdom, Stephen led an expedition against their chief Kean, and gained a decisive victory over him. The third invasion against Stephen was one conducted by Henry, the son of the emperor Conrad, who had already advanced as far as the Raab with a powerful army. The occasion of this seems to have been a misunderstanding; for after some negociations the army returned without having fought a single battle. These were the only instances in Stephen's long reign which obliged him to have recourse to arms. Indeed his court was so well known for the security which it afforded, that the two English princes Edwin and Edward, who had been exiled by Canute, came over to Hungary and lived under king Stephen's protection. The whole of his attention was given to the firm establishment of Christianity, and no means were neglected by him which could induce the few who still persevered in heathenish practices to adopt it.

He divided Hungary into ten bishoprics, which were plentifully supplied with monasteries built by Greek architects. Schools were also established, the first and best of which was that of St. Gerard, who had been tutor to prince Emeric, the king's son. It was afterwards entrusted to the direction of Walter, a monk of Bákony Bél, the fifth monastery founded by Stephen. The country itself being now provided with ecclesiastical and school establishments, a monastery was built at Ravenna for the use of Magyar pilgrims on their way to Rome, where the munificent king had erected a college with a foundation for ten canons, and an inn for his subjects whom the desire of learning might lead to Rome. A large convent in the neighbourhood of Constantinople was the resting-place for Hungarian monks who wished to join their brethren at Jerusalem, and who were entirely supported by the king.

These and many other pious and charitable institutions of St. Stephen, joined to his own exemplary life and precepts, soon rooted out the last remnants of paganism. His constitution, which is undoubtedly the foundation of the present Hungarian government, but of which we have no well authenticated remains, finished the work of civilization which he had begun thirty years before.

At this period of his life, being fifty-one years of age, he lost his son Emeric, who, under the able tuition of Gerard, had all the accomplishments of his time, and was in every respect worthy of his father. Emeric was married to the daughter of Kresimir, king of Croatia, but he died without issue.

Stephen's grief for the loss of his son was increased by the treachery Gisela, who put out the eyes of Vazul, whom Stephen had designed for his successor, in order that her own son Peter might succeed to the throne. These causes of sorrow so affected Stephen's health that they brought on an illness which afflicted him till his death. About this time an attempt was made against his life by a murderer, who was incited by four of the principal men of the court. On the failure of his attempt, the miscreant fell upon his knees and confessed all. Stephen gave a general pardon to all who were concerned in the crime. He died on the 15th of August, 1038 (the day of his coronation), forty-one years after the death of his father. In 1083 his relics were enshrined by St. Ladislaus, in a rich chapel which bears his name, in the church of our Lady of Buda. The 20th of August, the day of the translation of his relics, is kept in Hungary as a festival.

St. Stephen was canonized by Benedict IX.; and pope Innocent XI., in 1686, appointed his festival to be kept on the 2nd of September, the emperor Leopold having on that day recovered Buda from the Turks. (Chartuitius, *Vita S. Stephani.*)

STEPHEN II., king of Hungary, son of Koloman, whom he succeeded in 1114, at the age of fourteen. He was of a weak intellect, and unwilling to submit to the judgment of his advisers, but was accustomed to act from the impulse of the moment. This quality gave him the name of 'the Lightning, or 'the Thunderer,' and rendered him odious to his subjects. Soon after his accession to the throne he made war on the Venetians, who could not be reconciled to the loss of Dalmatia, which had been taken from them during the reign of Stephen's father. They sent a fleet, with a considerable army, under the Doge Ordelaf Faledro, who however did not recover this province, the possession of which was of the greatest importance to the republic. The hostilities, which lasted two years, ended with a treaty which secured the mainland of Dalmatia to Stephen, whilst Venice obtained the adjoining islands. This transaction was scarcely concluded, when Stephen went (1116) to meet Wladislaw, the chief of the Bohemians, for the purpose of renewing the treaties of friendship which had long existed between the two countries. Unfortunately, through the treachery of an individual whose name was Solth, the meeting terminated in a quarrel attended with bloodshed; but after a few months the traitor was executed, and the old treaty renewed. The taste for war which Stephen showed throughout his reign, and the eagerness with which he sought every opportunity of satisfying his warlike disposition, countenance the assertions of some writers, that he himself

was a participator in this dishonourable transaction. In the two following years Stephen invaded Poland and Austria, from which expeditions he derived no material benefit. In 1119 he resolved upon an incursion into Austria, thinking that the great forces which he had assembled, and the apparent carelessness of the empire, would secure his success. But the emperor Leopold, after a decisive battle, in which the Hungarian army was completely beaten and obliged to retreat, pursued them as far as Eisenberg, and compelled Stephen to desist from his incursions.

The bad feeling which such acts had produced in the people was only checked by the great respect for kingly authority; but Stephen at last excited general indignation by filling the country with foreigners, to whom he showed a decided preference. This foolish policy was followed, in 1127, by a war with the grand-duke of Muscovy, Wladimir Monomakh. Yaroslaw, the exiled prince of Wladimir, applied to Stephen for aid. The Hungarian army marched into Russia, and advanced without opposition as far as Wladimir. At this crisis Yaroslaw died, and with his death the cause of the war ceased. But instead of returning, Stephen insisted upon storming the town; and in consequence of his obstinacy, the chief nobles of his army, with Kozma Peznan at their head, declared that if he would not immediately follow them into their own country, they would elect another king, and leave him to the mercy of the Russians. Intimidated by these threats, Stephen returned to Hungary; but his conduct compelled many of those who were concerned in the revolt to fly to Constantinople. Here they were well received by the emperor John II., who, upon Stephen's threatening to invade the empire, sent a powerful army against him, which completely defeated the Hungarians at Uj Palanka. When peace was restored, Stephen adopted Bela, the son of his relative Amos, who had been obliged to seek protection at the court of Constantinople, and resigned in his favour in 1131. He then entered a monastery, and died at Waradin, in the thirty-first year of his age.

STEPHEN III. was crowned king of Hungary in 1161, under unfavourable circumstances, arising from the influence which the emperor of Constantinople had exercised over Hungary during the reign of his father. Although Stephen had legitimate claims to the throne, and was generally beloved by the Hungarian nobles, the emperor Manuel did not approve of his spirit of independence, and signified to the Hungarians that unless they elected Ladislaus, the brother of the late king, he would invade the country. Ladislaus had been brought up at the Byzantine court, and had the Greek interest much more at heart than the Hungarian. Terrified by the approach of a formidable army, the Hungarian nobles elected Ladislas, who however died in 1161.

STEPHEN IV. On the death of Ladislaus, Stephen IV. was forced upon the Hungarians by the emperor Manuel; but no man could be less acceptable to the Hungarians than the debauched uncle of the unfortunate Stephen III. A revolt soon compelled him to seek refuge at the court of his patron, and the lawful king, Stephen III., was unanimously re-elected. During the usurpation of his uncle, Stephen lived under the protection of the archbishop of Gran, Luke Banfi. Manuel seemed to approve of the newly elected king, and gave his daughter in marriage to Bela, the brother of Stephen, on condition that the prince should live at Constantinople. Stephen agreed to this; but upon the arrival of Bela at Constantinople, the emperor claimed his heritage, which consisted of Dalmatia. Stephen refused to admit his claim; whereupon his uncle, Stephen IV., re-appeared at the instigation of Manuel, and commenced hostilities. He was however defeated in a battle by his nephew, and obliged to fly to Semlin, where he died in 1163. Soon after his death Semlin was taken, the kingdom cleared of the partisans of the Greek cause, and in an expedition into Dalmatia, which was conducted by Stephen himself, in 1165, this province was recovered from the hands of Manuel. But whilst engaged in the western parts of his kingdom, a Greek army appeared in Hungary. Stephen went to meet it; and a decisive battle, in which the Hungarians were defeated, secured the influence of Greece in Hungary. Stephen died in 1173, and was succeeded by his brother Bela III.

STEPHEN V., king of Hungary, succeeded his father Bela in 1270, and began his reign by a war against Ottocar, king of the Bohemians, whom he defeated. A subsequent campaign against the Bulgarians was crowned with success; but the course of his victories was interrupted by his death, which occurred in 1272.

This king is sometimes called Stephen IV. by those who do not recognise the usurper of that name.

(Thwrocz, *Chronica Hungarorum*; Ranzanus, *Epitome rerum Hungaricarum*; Bonfinius, *Rerum Hungaricarum Decades Quatuor*; Mailáth, *Geschichte der Magyaren*.)

STEPHEN, king of England, born A.D. 1105, was the third of the four sons of Stephen, earl of Blois, by Adela, daughter of William the Conqueror; and was consequently nephew of Henry I., cousin to that king's daughter the empress Matilda, and second cousin to Matilda's son, who became king of England as Henry II. Having been early brought over to England by his uncle Henry I., that king, with whom he became a great favourite, besides bestowing upon him several valuable estates here, made him earl of Mortagne in Normandy. Dr. Lingard says that Stephen 'had earned by his valour in the field of Tenchebrai the Norman earldom of Mortoil' (*Hist. of Eng.*, i. 158). But when the battle of Tenchebrai was fought, in 1106 [HENRY I.], Stephen was only about a twelvemonth old. Henry also procured for him a marriage with Matilda, the daughter and heiress of Eustace, earl of Boulogne (younger brother of the famous Godfrey and Baldwin, kings of Jerusalem), by which he acquired that earldom, and also a new alliance with the royal families both of England and Scotland, for the mother of Matilda of Boulogne was Maria, daughter of Malcolm Canmore, and a younger sister of Henry's queen Matilda (the good queen Maud). As Stephen therefore was the nephew of Henry I., so his wife was the niece of Henry's queen; and by this match the issue of Stephen, as well as the issue of Henry, might boast of inheriting the blood of the old Saxon royal family, as being equally sprung from Malcolm's queen Margaret, the sister of Edgar Atheling, a circumstance by no means without its influence in the contentions of the two lines.

When Henry, after the loss of his son and the failure of issue by his second wife, determined upon securing the succession to the crown for his daughter the empress Matilda, the two individuals upon whom he appears to have principally relied for the support of that arrangement were his natural son Robert, earl of Gloucester, and his nephew Stephen. It is not improbable that both may have meditated the attempt which Stephen actually made, and that, if the crown upon Henry's death had not been seized by him, it might have been clutched at by Gloucester. The notions of that age were by no means so settled in favour of legitimate birth as to have prevented the son of the late king, although illegitimate, from having a fair chance in such a competition against his nephew.

Perhaps Henry himself was not without his fears of one or both. He must have felt at least that the existence of two males so nearly connected with the royal house, and distinguished both for military talent and popular manners, tended to make still more precarious the success of his novel project of a woman-king, a thing opposed to all the notions and habits of the Gothic nations, and (if we except the single instance of a wife of one of the kings of the West Saxons, who is said to have retained the government in her hands for a year after the death of her husband, and then to have been expelled with disdain by the nobles, who would not fight under a woman) unexampled either in England, or in France, or in Normandy, or in the kingdoms of Denmark and Norway, whence the Normans came. At the same time, it was obviously much better for Matilda that she should have two such near male relations than if she had had only one; seeing that, if she had to fear a rival in one of them, she might count with equal certainty upon having a defender in the other. But that which after all gave her her best chance was the circumstance of her having had the good fortune to give birth to a son a few years before her father's death. Indeed she had borne two sons to her second husband before her father died. Had it not been for these lucky accidents, it may be doubted if all her father's provident arrangements would have secured the recognition of Matilda's pretensions for a moment after the throne became vacant. But for the existence of the infant Henry of Anjou, or of his younger brother, at the time of his grandfather's death, the crown might probably have been Stephen's without striking a blow—unless there had ensued a fight for it between him and his cousin Gloucester.

In 1125, immediately after the death of her first husband the emperor Henry V. (whom she was suspected of having made away with), Henry had sent for his daughter to Nor-

mandy; and, having the next year brought her over to England, he collected all the chief persons of the realm about him at Windsor while he kept his Christmas, and, having there by presents and promises engaged those among them of greatest influence to support his views, he came to London, and, having proposed the matter in a council consisting of the archbishops, bishops, abbots, earls, and all the thanes, obtained, in the beginning of January, 1127, though not, says Malmesbury, without great and long deliberation, the unanimous promise of the assembly, that, if he should die without male issue, they would receive Matilda as his successor. Every individual present who seemed to be of any note—quicunque in eodem concilio alicujus videbatur esse momenti (to adhere to Malmesbury's remarkable expression)—took a solemn oath to that effect; first the archbishop of Canterbury and the other bishops and abbots, then the king of Scotland on account of the fiefs he held of the English crown, then Stephen, earl of Boulogne and Mortagne, then the earl of Gloucester, then the other barons. 'But betwixt the earl of Boulogne and the earl of Gloucester,' says Lord Lyttelton, 'there was a dispute about precedence; not (as I apprehend) which should be foremost to show his zeal for Matilda's succession (though that might be the pretence for it), but to determine a question of the greatest consequence if she should die before the king, namely, which of the two was nearest to the throne. And its being now decided in favour of Stephen, on account of the illegitimacy of his competitor, was of no little service to him afterwards, even against Matilda herself, as he was thereby acknowledged first prince of the blood. It also removed out of the way of Stephen a very considerable obstacle to his ambition, by the discouragement it gave in the eye of the public to the earl of Gloucester's pretensions, who wanted not precedents, either in England or Normandy, to authorise his aspiring to the throne of his father in default of lawful issue male. But a solemn determination, which assigned the precedence to the nephew of the king above his natural son, was a prejudication of the right of succession in favour of the former.' A few months after this Matilda was married to Geoffrey Plantagenet, the son of the earl of Anjou; and in the year 1131, when she was in England, having already quarrelled with her husband, the oath of fealty to her was again taken by the bishops and nobility at a grand council held at Northampton. And two years after, on the birth of Matilda's first son Henry, it was once more renewed, in a council held at Oxford, both to her and to her son.

Nevertheless, as soon as Henry had expired in Normandy, 2nd December, 1135 Stephen, who, as well as Gloucester, had been for some time in attendance on the dying king, instantly set out for England, and taking ship at Whitsand, near Calais, the usual port of embarkation, landed on the coast of Kent. It appears that, foreseeing his uncle's decease, he had already secured the support of a powerful faction of the clergy and nobility, by means of his younger brother Henry, who, having also stood high in the favour of the late king, had been placed by him in the bishopric of Winchester, and had succeeded in winning over to his brother's interest the most influential subject in the kingdom, Roger, bishop of Salisbury, who, as grand justiciary, was the supreme governor of the realm during the vacancy of the throne. Of Stephen's two eldest brothers, it may be here mentioned that William, the eldest, was almost an idiot, and that the other, Theobald, had succeeded to his father's earldom of Blois; so that Stephen, in aspiring to the English crown, did not find either of them in his way. The politic and zealous management of his brother Henry had also gained for him the support of William de Pont de l'Arche, who held the castle of Winchester and the key of the royal treasures deposited there. The consequence was, that although Stephen was refused admission by the inhabitants both at Dover and at Canterbury, he was received with warm welcome by those of London and Winchester; and after Hugh Bigot, earl of Norfolk, the steward of the royal household, had, to remove the scruples, real or affected, of some of his adherents, boldly sworn that Henry on his deathbed had disinherited his daughter and her issue, and left the crown to his nephew, it was resolved by the clergy and nobility who had gathered about him that he should be crowned forthwith, and the ceremony was accordingly performed at Westminster on the 26th of December, St. Stephen's-day, by the archbishop of Canterbury, assisted by the bishops of Salisbury and Winchester. The commencement of the reign of Stephen is reckoned from that day.

At his coronation Stephen swore, 1, That on all occasions of episcopal vacancies he would appoint a new prelate within a certain time, and meanwhile would leave the temporalities of the see in the charge of some ecclesiastic; 2, That he would make no addition to the royal forests, but would, on the contrary, restore to their owners such lands as had been made forest by his predecessor; 3, That he would abolish the tax called Danegelt, which, after having been given up by the Confessor, had been restored by the Norman kings. On the other hand, the bishops tendered their allegiance only for so long as the king should maintain the privileges of the church; and the lay barons appear to have also qualified their oath by a similar condition as to his preservation of their estates and honours. Nothing like this had taken place at the commencement of any previous reign since the Conquest.

In January of the following year, 1136, after seeing the body of the late king interred at Reading, Stephen convened a great council of the bishops and the nobility at Oxford, and there signed a charter of the liberties of the church and state, in which he styled himself 'Stephen, by the grace of God, elected king of the English by assent of the clergy and the people, consecrated by William, archbishop of Canterbury and legate of the holy Roman church, and confirmed by Innocent the Pontifex of the holy Roman see.' He had shortly before this obtained a bull from pope Innocent, confirming his election. In this charter he repeated more distinctly the engagements under which he had come at his coronation, declaring besides that he would cause to be observed all the antient and just laws of the kingdom. There is also a shorter charter of Stephen's, dated at London, which seems to have preceded this, and which was probably granted at or immediately after his coronation. In that he expressly grants to his French and English subjects all the good laws and good customs which they had in the time of the Confessor, a clause which is not found in the larger charter. The confirming clause of the latter also has the qualification, '*salva regia et justa dignitate mea*'—saving *my royal* and just dignity,—which the other is without.

Meanwhile a feeble attempt had been made by Matilda and her husband to take possession of Normandy; but the Normans themselves, without any assistance from Stephen, soon drove out the army of Angevins which had entered their country. In England at this moment not a hand or voice was lifted up for the daughter of the late king. Even the earl of Gloucester came forward with the other barons, and did homage, and took the oath of fealty, to Stephen.

After a short while, however, opposition arose in various quarters. In the spring of the year 1136, king David of Scotland, Matilda's uncle, advancing at the head of an army, overran the northern counties, and compelled the barons of those parts to swear fealty to Matilda, and to give hostages for the performance of their oath; and although he agreed to a peace when Stephen marched against him, and restored the lands and castles he had taken, he refused to do homage to the king of England for his possessions in that country. He suffered his eldest son Prince Henry however to do homage for the honour of Huntingdon, which, with the towns of Carlisle and Doncaster, was conferred upon him by Stephen. Meanwhile, during Stephen's detention on the northern borders, an insurrection in favour of Matilda broke out in Wales, which he never could effectually suppress, but was obliged to satisfy himself with merely endeavouring to prevent from extending itself beyond that quarter of the kingdom. Then, although he had obtained the investiture of the duchy of Normandy from the French king Louis, it soon appeared that his possession of the country was only to be retained by force of arms, and that while he had to keep back with the one hand the persevering attacks of the Angevins, he had an almost equally troublesome enemy to keep down with the other in the native chiefs, a large proportion of whom, sometimes arraying themselves on his side, sometimes on that of Matilda, evidently aimed at taking advantage of the contest between the two rivals, to throw off the yoke of the one as well as of the other, and to secure, if not the national independence, at least their individual emancipation from all superiority. And the same spirit quickly began to show and spread itself in England. In some districts the standard of Matilda was raised by the earl of Gloucester, and

various places of strength were seized upon and garrisoned in her name; elsewhere the barons fortified their castles on their own account, and set up each as an independent chieftain. Stephen had his hands full of work with all this disorder and rebellion in the south, when the king of Scotland again appeared on the northern borders. After having ravaged Northumberland with unusual ferocity in the winter of 1137, David and his half-barbarian host retired to Roxburgh, on the approach of the English king in the beginning of the following year; but as soon as Stephen was recalled to the south, the Scots again crossed the border in the end of March, 1138. They had taken the castle of Norham, and laid siege to other fortresses, when they were met by Thurstin, archbishop of York, at the head of an army composed of the retainers of the northern English barons, and defeated by him in the famous battle of the Standard, fought on the 22nd of August, 1138, on Cutton Moor, in the neighbourhood of Northallerton. Peace however was not concluded with the Scots till the 9th of April in the following year, when Stephen found himself under the necessity of yielding up to Prince Henry the earldom of Northumberland, with the exception of the forts of Newcastle and Bamborough, for which he engaged to make over to him estates of equivalent value in the south of England.

But by this time the unfortunate English king had found another, and, as it turned out, by far his most formidable enemy. He had quarrelled with the church. Resolved to reduce the inordinate power of Roger, bishop of Salisbury, and his two nephews, Alexander and Nigel, bishops of Lincoln and Ely, he had at a council held at Oxford, in June, 1138, arrested Roger and Alexander; and although Nigel made his escape, he was eventually compelled to surrender his castle of Devizes, as his brother and his uncle had been to give up theirs of Newark, Salisbury, Sherburn, and Malmesbury. The inflammation excited in the whole ecclesiastical body by this attack was terrific. Even the king's brother, the bishop of Winchester, who had been lately made papal legate, was either carried away by the general feeling of his order, or, if he did not share in that feeling, found it would be in vain for him to resist it. He summoned his brother to answer for what he had done before a synod of bishops, which met at Winchester. Stephen complied so far as to send one of his ministers to plead for him, who, when the decision upon a preliminary question had been given against the king, appealed to Rome; on which the legate dissolved the synod, on the 1st of September, 1139. On the last day of the same month Matilda landed on the coast of Suffolk, and immediately after the earl of Gloucester unfurled his standard in the west. The war spread rapidly over the whole kingdom. At length, on the 23rd of February, 1141, Stephen, while besieging the castle of Lincoln, which was held by Ranulph, earl of Chester, was attacked by the earl of Gloucester, and being taken prisoner, was immediately, by Matilda's order, consigned in chains to the castle of Bristol.

On that day month Matilda and her brother, attended by a numerous body of barons of their party, met the legate on the open downs in the neighbourhood of Winchester, when it was solemnly agreed that Henry and the church should acknowledge her as their sovereign, on condition that he should be made her first minister, and especially that all vacant bishoprics and abbacies should be filled up on his nomination. Soon after this the archbishop of Canterbury and all the other bishops gave in their adherence. In the beginning of April the heads of the church met on the summons of the legate at his episcopal city of Winchester; and there he addressed them in a long speech, which Malmesbury, who heard it, has preserved; and in the end the meeting unanimously agreed to confirm his treaty with Matilda. A remarkable circumstance mentioned in the account of this meeting is the appearance of certain deputies from the citizens of London, who, it is stated, on account of the greatness of their city were considered as nobles in England, and who had been summoned to give their attendance by the legate, although the assembly was otherwise composed only of ecclesiastics. They at first stood up for Stephen, but were ultimately persuaded to concur with the rest of the meeting.

But the folly, rapacity, and insolence which Matilda now displayed in her triumph, were soon found to be insupportable by all parties. Taking advantage of the strong popular feeling of disgust, Stephen's queen Matilda, who had remained in arms for her husband in the county of Kent, made her appearance before London while the empress lay there awaiting her coronation; and she barely contrived, by springing from table and mounting her horse, to effect her escape to Oxford. The legate now joined his sister-in-law and the Londoners; the empress, with the king of Scots, the earl of Gloucester, and others of her principal adherents, besieged in the castle of Winchester, fled from that stronghold on the morning of Sunday, the 14th of September, when, being immediately pursued, many of the party were killed; most of the rest, including the earl of Gloucester, were taken prisoners, and Matilda herself with difficulty escaped to the castle of Devizes. Negociations were now opened, the result of which was that in the beginning of November Gloucester was exchanged for Stephen. When his brother was thus again at liberty, the legate once more summoned a clerical synod at Westminster, on the 7th of December, at which he defended his abandonment of the cause of Matilda, and as usual carried his brethren along with him in his new course of politics. Stephen himself, having appeared among them, addressed them with pathetic eloquence on the wrongs and indignities he had sustained; and they ended by resolving unanimously to excommunicate all who should adhere to 'the countess of Anjou.'

The war now recommenced after Stephen had recovered from an illness which confined him for some months, and Gloucester had returned from the Continent, whither he had gone to endeavour to persuade Matilda's husband to come over to her assistance, an attempt in which he met with no success, although Geoffrey consented to entrust his eldest son Henry to the earl's care. In the end of September, 1142, Stephen laid siege to the castle of Oxford, in which Matilda resided; but when the garrison, from want of provisions, could hold out no longer, the empress, on the 20th of December, in a severe frost, and while the ground was covered with snow, slipped out at an early hour in the morning attended by three knights, made her way through the posts, crossed the Thames on the ice, walked to Abingdon, and thence rode to Wallingford. Other sieges, battles, and skirmishes followed, and the kingdom remained subject generally in the eastern counties to Stephen, in the western to Matilda, till the death of the earl of Gloucester, the main support of the latter, in 1146, upon which she retired to Normandy. But her absence brought little more quiet to Stephen. The next two or three years of his reign were disturbed by a formidable rebellion of a confederacy of the barons headed by Ranulf, earl of Chester, and also by another quarrel with the clergy, whose hostility Stephen brought upon himself this time by his support of their old leader his brother Henry, when that intriguing and ambitious prelate, whom the pope, at the instigation of Theobald, archbishop of Canterbury, had deprived of his office of legate, sought to avenge himself on the primate by the aid of the royal authority. Matters proceeded so far that Theobald at last published a sentence of interdict, the first of which this country had ever been the object, against all the dominions of the English king; and Stephen, assailed by the cries of the alarmed people, found himself forced to yield. But his last and worst antagonist now appeared in the person of Matilda's son Henry, who, having by the death of his father, in September, 1151, become earl of Anjou, and having soon after added to his paternal dominions the territories of Poitou and Aquitaine by his marriage with Eleanor, the divorced wife of Louis VII. of France, landed at Wareham, on the 6th of January, 1153, at the head of a force of only 3000 foot and 140 knights, which however was soon augmented by the junction of considerable numbers of his mother's friends. Yet no swords were crossed by these rival claimants of the same crown. Henry having forced his way into the town of Malmesbury, lay there, while the Avon, rendered impassable by the rains, prevented Stephen from attacking him. Stephen then retired to London, on which Henry advanced to Wallingford; but when Stephen had also marched to this point, and both parties were preparing for battle, the principal persons in the two armies, at the suggestion of the earl of Arundel, interfered, and an agreement was made, by which the effusion of blood was prevented, and which was confirmed in a great council held at Winchester in November following. By this compact, Stephen, whose eldest son Eustace, fortunately for the peace of his country, died suddenly at Canterbury during the negociation, having been seized, it is said, with fever and

phrenzy, while he sat at table, constituted Henry, whom he styled duke of Normandy, 'his successor in the kingdom of England, and his heir by hereditary right.' Henry in the meantime did homage and swore fealty to Stephen; Stephen's surviving son William did homage to Henry, and received from him a grant of all the lands and honours held by his father before his accession to the throne; and, lastly, the bishops and abbots, the earls and barons, and the inhabitants of all the boroughs in the kingdom, swore fealty to both the king and the duke. One of the most strenuous supporters of this arrangement was the bishop of Winchester. Stephen survived its ratification not quite a year; he died suddenly in a convent at Dover, on the 25th of October, 1154, being in the 50th year of his age, and having reigned nineteen years all but two months. [HENRY II.]

England during the whole reign of Stephen was probably in a state of greater anarchy and misery than it had ever known since the first settlement of the Saxons, or has ever experienced in the worst of the intestine wars and confusions of which it has since been the theatre. Indeed the country appears to have got far back towards barbarism. 'In this king's time,' says the Saxon Chronicle, 'all was dissension, and evil, and rapine. . . . Thou mightest go a whole day's journey, and not find a man sitting in a town, nor an acre of land tilled. The poor died of hunger; and those who had been men well to do begged for bread. Never was more mischief done by heathen invaders. . . . To till the ground was to plough the sands of the sea. This lasted the nineteen years that Stephen was king, and it grew continually worse and worse.'

Yet Stephen personally appears to have had many qualities which would have adorned a throne more fortunately circumstanced. The party zeal of the old historians has given very opposite representations of his character; but his general conduct, and the best or most impartial authorities, bear out what has been said of him by Stow:—'This was a noble man and hardy, of passing comely favour and personage: he excelled in martial policy, gentleness, and liberality towards all men, especially in the beginning; and, although he had continual war, yet did he never burthen his commons with exactions.' His valour and clemency indeed, as well as the beauty of his person, are admitted on all hands, and are attested by the whole of his career, and by many remarkable incidents. He is especially spoken of in terms of the warmest eulogy by one contemporary writer, the author of the Life of St. Cuthbert, lately printed by the Surtees Society, 'Reginaldi Monachi Dunelmensis Libellus de Admirandis Beati Cuthberti Virtutibus,' 8vo., Lon., 1835. See his 64th chapter.

By his queen Matilda, who died 3rd May, 1151, Stephen had the following sons and daughters:—1, Baldwin, who died in infancy; 2, Eustace, after his father's acquisition of the crown styled earl of Boulogne, who was born in 1135, married, in 1138, Constance, daughter of Louis VI. and sister of Louis VII. of France (afterwards the wife of Raymond III., earl of Toulouse), and, as already mentioned, died 10th of August, 1153, without issue; 3, William, who married Isabel, daughter and heiress of William, earl of Warren and Surrey (afterwards the wife of Hamlyn Plantagenet, natural son of Geoffrey, earl of Anjou), became earl of Mortagne and Boulogne after the death of his elder brother, and died without issue in October, 1160; 4, Maud, who died in childhood; 5, Mary, who, after becoming a nun, and abbess of the nunnery of Ramsey in Hampshire, succeeded, on the death of her brother William, to his honours of Boulogne and Mortagne, and some years afterwards married Matthew, son of Theodoric of Alsace, earl of Flanders, with whom she lived ten years, and was then, in 1189, divorced by the pope and sent back to her convent, after having borne Theodoric two daughters, the youngest of whom, Maud, through her granddaughter Elizabeth, the wife of Albert I., duke of Brunswick, is among the ancestors of the present English royal family. Two natural sons are also attributed to Stephen: William, of whom nothing is known except the name; and Gervais, by a lady named Danota, made by his father abbot of Westminster, which dignity he held till his death, 26th August, 1160. Stephen's younger brother Henry, the bishop of Winchester, who figures so conspicuously throughout the reign, died 6th August, 1171.

The chief contemporary chroniclers of the time of Stephen are, the writers of the 'Saxon Chronicle,' the anonymous author of the 'Gesta Stephani' (published in Duchesne), Richard, prior of Hexham (Hagulstadensis), Serlo, and Ailred, abbot of Rivault (all in Twysden's 'Decem Scriptores'), William of Malmesbury, and Henry of Huntingdon. Many additional facts are also mentioned by Ralph de Diceto, Brompton, Gervas of Canterbury, and other later writers.

STEPHEN, BATHORI, one of the most remarkable individuals of the sixteenth century, and the greatest king that Poland ever had. He was born in 1533, at Shomlo in Hungary, of an old and noble family of that country. The agitated state in which his native land continued during the sixteenth century, being torn by domestic factions, and troubled by the Turks and the Austrians, presented a vast field for the display of great talents, united to a daring and adventurous character, and Stephen Bathori rose after many vicissitudes to the sovereignty of Transylvania in 1571. In 1575 he was elected to the throne of Poland, vacant by the flight of Henry of Valois (Henri III. of France); and he owed this elevation to the renown of his valour and wisdom. He took possession of the crown; married, according to the conditions of his election, the princess Anna Jaguellon, sister to the deceased king Sigismund Augustus; repressed by his vigour the party which supported his competitor Maximilian of Austria; and pacified the country by conciliatory measures.

The true test of really great men is the ability of filling the shortest possible space of time with the largest amount of great deeds, and few characters in history may lay a better claim to having fulfilled these conditions than Stephen Bathori.

After having regulated the internal affairs of the country, he settled its foreign relations in a satisfactory manner, particularly by ensuring the friendship of the sultan of Turkey. He then turned his attention towards Muscovy. This power had recently obtained an extraordinary development under the celebrated Ivan Basilovich, who invaded a part of Livonia belonging to Poland shortly after the accession of Stephen. His first care was to organise a military force adequate to encounter such a formidable enemy, and to secure at the same time the tranquillity of the borders. He formed the Cossacks of the Ukraine into a regular force, allowing them the choice of their own hetman or supreme commander, and conferring on them many advantages as a reward for the services which they were obliged to perform. The castles were repaired and provided with permanent garrisons; a formidable ordnance was created; and a body of life-guards and a regular infantry were organised.

Having completed his military preparations, he took the field in the summer of 1579 with a numerous army composed of national troops, German mercenaries, and five thousand Hungarians, commanded by Bekesh. Bekesh, a countryman of Bathori, had been his enemy and competitor for the throne of Transylvania, but finally, struck with admiration of the superior qualities of Bathori, he disclaimed his enmity, and requested the honour of serving under his command. These sentiments were fully responded to by Bathori, who placed in his former enemy an unlimited confidence, which Bekesh justified by his services.

On commencing the campaign, Bathori issued a proclamation to the people of Muscovy, declaring that he was making war against their tyrannical sovereign, and not against them, and promising protection to their lives and property. The Russian historians bear evidence that this promise was strictly fulfilled, and that this campaign was free from all those atrocities by which war was usually accompanied in those times. The Muscovites were defeated in several battles. Polotzk was taken after a desperate resistance; but the garrison and inhabitants were spared by the conqueror, who immediately granted to the town the liberties enjoyed by the cities of Poland, and the same privileges and security to the Greek church which it had enjoyed under the dominion of Moscow. Having restored that important place to Poland, from which it had been taken several years before, he obtained some other advantages during the same campaign, and returned in the winter to Warsaw to attend the diet, which received him with great enthusiasm, and willingly granted the necessary means for the continuation of the war. Bathori resumed it with great vigour in the summer of 1580; the town of Veliki Luki and several others were taken: and in the next year, 1581, the city of Plescow was besieged by Zamoyski, one of the greatest statesmen and warriors that Poland had

produced [ZAMOYSKI], and to whom Bathori had entrusted the command of the army. The progress of the Polish arms was arrested, and the fruits of so many triumphs were destroyed, by the intrigue of the Jesuit Possevinus, who, deceived by the promises of the czar Ivan Basilovich to acknowledge the supremacy of the pope, induced Stephen Bathori to conclude peace with Muscovy on the 6th January, 1582, by which the Polish conquests were restored to the czar, with the exception of Polotzk and a few other towns and castles. Bathori employed the interval of peace in introducing different improvements, and was making preparations for another war with Muscovy, the dangers of which his policy could easily foresee. The pope, Sixtus V., deceived by the czar, who as soon as the danger was over thought no more about submitting to Rome, granted the Polish king a considerable subsidy. The projects of Bathori against Muscovy, which are supposed to have had for their object a change in the form of the government of that country, were cut short by his death, after a short illness at Grodno, on the 12th December, 1586, at the age of fifty-four.

The wars in which he was engaged did not prevent him from paying due attention to the civil affairs of the country, in which the following improvements were introduced during his reign. The province of Mazovia, which had hitherto been governed by a separate code, was induced by Stephen to adopt the general laws of Poland, with some few exceptions. The statute-book of Lithuania was enlarged by the addition of many new articles. The statute of Culm, by which the towns of Prussia were governed, was revised. Many salutary laws respecting the property of the crown and the privileges of the nobles were enacted. But the most important civil act of this king was the establishment of tribunals or supreme courts of justice for Poland and Lithuania. They were composed of members elected for the session by the same voters who returned the nuncios, or members of the diet. This institution, which supplanted the administration of justice by the king, and rendered it independent of the crown, continued till the dissolution of Poland. [POLAND, *Constitution of*.]

Stephen Bathori was very fond of learning and a great patron of learned men. In his early life he was imprisoned for two years in a fortress, by the emperor of Austria, which time he spent in the study of the classics, and particularly in that of the 'Commentaries' of Cæsar, which he is said to have known by heart. He is supposed to have been originally a Protestant, but to have been induced by the representations of a Roman Catholic bishop to abjure secretly his creed and to become a Roman Catholic on his accession to the crown of Poland, so that many believe that he had always conformed to the Roman Catholic church. Some learned Jesuits having gained his confidence, he became a great patron of their order, and founded for them the university of Wilna and the college of Polotzk, which he richly endowed. He was however strongly opposed to religious intolerance, and maintained evenhanded justice amongst the various denominations which prevailed in Poland. He was of a generous and forgiving disposition, as an instance of which we may quote the following anecdote:—A noble called Penkoslawski, who was a very gallant officer, violently opposed the king as a nuncio at a diet. It happened that just at that time the grant of an estate was to be made, and Stephen gave it immediately to Penkoslawski, saying, 'He is as good a soldier as he is a bad nuncio.'

He left no issue, and resigned, on his election to the throne of Poland, the principality of Transylvania to his brother Sigismund.

As a proof of his tolerant spirit and enlightened mind, we may adduce his favourite saying—'that God has reserved three things to himself; the creation of something out of nothing, the knowledge of futurity, and the government of the conscience.'

STEPHENS (French, **ETIENNE** or **ESTIENNE**; Lat., **STEPHANUS**) is the name of a family of the most illustrious scholars and printers that has ever appeared. Several of the members of this family bore the same Christian name, which has produced much confusion in the accounts that have been given of them. We shall give the lives of them in a chronological succession, and distinguish those of the same name by the epithets the first, the second, &c. The earliest among them who distinguished himself is—

HENRY STEPHENS I., who was born at Paris; the year of his birth is uncertain, though it is generally supposed that it was about 1470. He had his printing establishment at Paris, in a place which he calls 'e regione scholæ decretorum,' which is now called 'Rue de l'Ecole de Droit.' The earliest work which is said to have been printed by him is of the year 1502, the year before that in which his son Robert was born. The works which he printed were mostly on theological, philosophical, mathematical, and medical subjects, and he published very few editions of the classical writers. On the title-page of his publications are represented two men looking at a shield which stands between them, and contains three lilies, and above them a hand holding a closed book. Above the heads of the two men is the device—'Plus olei quam vini.' At the bottom of the title-page he sometimes gives only his initials, H. S., and sometimes his full name. All the works that came from his press were very correctly printed, as he always revised the proofs. A list of his publications is given by Maittaire (*Historia Stephanorum*, ii. 1, p. 1-9, and by Renouard, vol. i.). from which we extract the following:—In 1512 he published the 'Itinerarium Antonini;' in 1519 the works of Dionysius Areopagita; in 1521 an extract of the 'Arithmetica' of Boethius. In 1522 his son Robert was engaged in the printing establishment of his father-in-law Simon de Colines, who calls himself the successor of Henry Stephens, and married his widow. From this fact we must infer that Henry Stephens died in 1521 or 1522. He left three sons, Francis, Robert, and Charles.

FRANCIS STEPHENS I., was the eldest of the three sons of Henry Stephens. He was a partner of Simon de Colines: there are very few books known to be printed by him. The earliest is a work called 'Vinetum,' printed in 1537. In 1543 he published a 'Psalterium Græcum,' in 16mo., in which the titles and the initials of the verses are printed in red. The last of his publications is the 'Andria' of Terence, in 8vo. His mark on the title-page is a tripod, which stands upon a book, and from which a vine-branch rises. The device upon the base is—πλέον ἐλαίου ἢ οἴνου, with the Latin translation, 'Plus olei quam vini.' The year of his birth as well as of his death are unknown. A list of his publications is given by Maittaire, p. 31, and by Renouard, vol. i.

ROBERT STEPHENS I., the second son of Henry Stephens I., was born at Paris in 1503. In his youth he studied the Latin, Greek, and Hebrew languages, and he made such progress, that at an early period of his life he gave most extraordinary proofs of his learning, and was subsequently placed by his contemporaries above the greatest scholars that had ever lived. After the death of his father, he was for some time engaged in the printing-office of Simon de Colines, his father-in-law, and he appears, as early as his nineteenth year, to have had the entire management of the printing, correcting, and editing of several works, for in 1522 there appeared from the establishment of De Colines an edition of the New Testament (*Novum Testamentum, Latinè*, in 16mo.), which, although a copy of the Vulgate, was more correctly printed than any previous edition, and also contained some corrections by Robert Stephens. The professors of the Sorbonne, alarmed at the appearance of a new edition of a book which they wished to keep from the public, especially at a time when Protestantism was making rapid progress, inveighed in their lectures against the audacious youth, and declared that the book should be burnt. But their anger produced little effect. A short time after this he married Petronella, a daughter of the celebrated scholar and printer Jodocus Badius, a woman of great talents, who understood and spoke Latin as well as her mother-tongue. As the house of Stephens was visited by scholars and eminent men of all countries, Latin became the ordinary language of conversation; and it is said that the children and even the servants acquired some facility in speaking it. After his marriage he established a separate printing-office for himself, though he remained in the same street in which his father's office was situated. The earliest publication from his own establishment was 'Apuleii Liber de Deo Socratis,' 1525, 8vo. Others believe that he had no separate establishment till two years later, and that Cicero's 'Partitiones Oratoriæ' and 'Persii Satyræ' (1527) were the first works that issued from it. These works were followed by a great number of Roman authors, and Latin translations from the Greek and other languages, some of which were made by himself. For many years scarcely a month passed without some new publication, and if we recollect that in most of the works he acted as editor, and

corrected the proofs with the most anxious care, it appears marvellous that so many works could be produced in so short a time; the mere list of his publications in Maittaire, from 1527 till 1560, which is not by any means complete, fills twenty large octavo pages (p. 10-30). His device on the title-page of his publications was an olive-tree with one or more branches broken off, while new branches are engrafted on the tree, and the motto was 'Noli altum sapere,' to which he sometimes added 'sed time.' Until the year 1532 he used the same types as his father, but in this year he used a larger and more elegant type for his 'Biblia Latina,' of which he had published the first edition in 1528, under the title 'Biblia utriusque Testamenti Latina, ex veteribus MSS. exemplaribus emendata,' fol. This edition was not only in appearance the finest that had ever been printed, but that he might be able to give the text with the utmost correctness, he had examined all the libraries of Paris, St. Germain, St. Denis, and had got over from Spain at his own expense a very valuable Spanish Bible.

In the year 1531 Stephens published his first great original work: 'Dictionarium, seu Latinae Linguae Thesaurus,' fol. The second (1536) and the third or last edition (1545) of this dictionary are in two volumes, folio, and contain numerous corrections and improvements by Robert Stephens. The work has often been reprinted in other countries.

In the year 1539 Stephens was appointed printer to the king of France for Latin and Hebrew works, and henceforth he always added on the title-page of his publications, to his name, Regius Typographus, or Regius Librarius, or some other similar title. Soon after this honour was conferred upon him he received the same distinction for Greek works, whence he calls himself sometimes 'Regius Typographus in Graecis.' Stephens appears to have thought that he ought to produce his publications in a form worthy of his new rank, and it was on his suggestion that Francis I. had new Hebrew, Greek, and Roman types made by Claude Garamond. These types, which were of exquisite beauty, were afterwards known under the name of Characteres Regii. In 1540 Stephens published a new edition of the Latin Bible with various readings. On its appearance the divines of the Sorbonne renewed their attacks, but owing to the king's liberal protection he was enabled to continue his labours unmolested. The king had such a high esteem for his learned printer, that he frequently visited him in his office, and on one occasion, when he found him correcting a proof sheet, he stopped behind him and waited silently till Stephens had finished his task, before he began to conver with him. The first Greek book that Stephens printed in the capacity of Regius Typographus in Graecis, belongs to the same year, 1540, and bears the title Γνῶμαι Μονόστιχοι, sive Sententiae singulis versibus contentae juxta ordinem Literarum ex diversis Poetis, cum Interpret. Latina.' In 1543 he published a little work called 'Alphabetum Graecum,' which only contained sixteen leaves, and was afterwards frequently reprinted. This is supposed to be the first book that was printed with the Characteres Regii. In the following year Stephens edited, in one folio volume, a collection of the most eminent Greek ecclesiastical historians, under the title 'Ecclesiastica Historia Eusebii, Socratis, Theodoriti, Theodori, Sozomeni, Evagrii, Graece.' This work was soon followed by 'Eusebii Praeparatio Evangelica' in Greek. These two volumes contain the earliest specimens of the device subsequently adopted by all royal printers: a thyrsus with an olive branch and a serpent wound round it, and the motto, βασιλεῖ τ' ἀγαθῷ κρατερῷ τ' αἰχμητῇ. In 1545 he published a new edition of the Latin Bible, which he had been preparing for several years. It contains notes which are ascribed to Vatablus, and which are said to have been communicated to Stephens by the pupils of this theologian. But the authorship of the notes is a point which, even at the time, appears to have been the subject of much dispute. In the year following he published his first Hebrew Bible, and also a new edition of the Latin Bible in folio, with a preface which shows the immense pains that he took to give the text as correctly as possible.

These repeated editions of the Bible and the notes ascribed to Vatablus, which were in some parts supposed to savour of the reformed doctrines, to which Stephens himself was attached, involved him again in disputes with the professors of the Sorbonne. He offered publicly to acknowledge any errors which he might have committed, and to print them in an appendix to his Bible, to guard the readers against them. The king several times required the professors to draw up a list of the errors or heresies, but they never did it. Their object was not to prevent the propagation of any particular errors, but to get the Bible and the commentary put into the Catalogus Librorum Prohibitorum, and thus to stop its sale altogether. The matter was constantly deferred, and all attempts to bring it to a close were fruitless. Stephens, in the meantime, regardless of the clouds which were gathering over his head, continued as active as ever. In 1547 he published the Editio princeps of the 'Antiquitates Romanae' of Dionysius of Halicarnassus, which is still highly valued as a very beautiful and correct edition. It was soon followed by the Editio princeps of Dionysius of Alexandria 'De Situ Orbis,' with the Greek scholia of Eustathius.

In this year (1547) king Francis I. died, and Stephens lost his greatest patron and protector. His successor, Henry II., was at first favourable to Stephens, and required the divines of the Sorbonne speedily to produce their 'censurae,' threatening to punish them if they made any further delay. The professors, who knew the vacillating and weak character of the king, promised obedience, but nothing was done, and new charges were brought against Stephens, and new attempts were made to suspend the sale of his Bible. At last it was agreed that Stephens and the learned divines should meet at the king's palace at Fontainebleau, where several bishops and cardinals likewise appeared. Stephens was acquitted of the charge of having printed anything that impugned the Roman Catholic faith. The divines, thus disappointed, suddenly contrived to give another turn to the matter, and to get an order from the king for a temporary suspension of the sale of Stephens's Bible, and for the matter to be investigated afresh by a commission, whose duty it was to take cognizance of cases of heresy. After eight tedious months, Stephens at last obtained from the king another order, that his case should be tried by the king's privy council only. When Stephens had thus, for a time at least, secured his tranquillity, he produced, in 1548, the Editio princeps of Dion Cassius, libri xxiii., and several other works. In this year he had occasion to travel to Lyon, and in this journey he is said to have made the subdivision of the chapters of the Bible into verses, which was subsequently adopted in nearly all editions of the Scriptures. King Henry II. happened to be at Lyon, and when Stephens, availing himself of the opportunity, presented himself before the king, and at the same time thanked Cardinal de Guise for the services he had done him, Stephens was informed, to his utter astonishment, that a change had taken place in the king's mind, in which he could not mistake the secret and intriguing workings of his adversaries: the sale of his Bibles was prohibited. Stephens, indignant at such proceedings, declared that he would leave his country; but the king requested him to retain his office of royal printer, and promised that the matter complained of (the censuræ) should be speedily produced.

Stephens was persuaded to remain; but, owing to the king's vacillation, he was still subjected to various disappointments and vexations. Some of his biographers state that in this year he visited Zürich and Geneva; and if this be true, he perhaps undertook this journey with a feeling that it would soon be necessary for him to seek a refuge in a foreign country. In 1550 he published his beautiful edition of the Greek Testament, with a 'nova translatio Latina.' Stephens presented this work to bishop Du Chastel, who had hitherto pretended to be his friend, but who now courted the favour of the Sorbonne, and declared that every sort of protection which he had formerly given to Stephens had arisen from his not knowing the real character of his offences. Hereupon the Sorbonne again began to annoy Stephens; and after a tedious and ludicrous trial, held by men who found fault with the various readings in the margin of Stephens's Bible, which they took to be an heretical commentary, he was forbidden to sell his impressions of the Bible, and commanded to promise that he would print no more copies of the Scriptures without the sanction of those learned divines.

Stephens was now convinced that no reliance could be placed either on the king, his counsellors, or the great prelates, and that he must be prepared for the worst. He however made preparations for a step which his enemies did not expect. He finished the numerous works which were at the time going through the press, and at the end of the year 1551, or at the beginning of 1552, he escaped with

his family to Geneva, where he hoped to find that liberty of conscience which he had so long wished for. Stephens is charged by some writers with having taken with him some of the materials belonging to the royal printing establishment, but his biographers have shown that there is not a shadow of ground for this charge. There is also a tradition, which does not seem at all improbable, that the professors of the Sorbonne vented their impotent rage by burning Stephens in effigy.

Stephens began his new career at Geneva with the publication of some books of the Old Testament, and of the whole of the New-Testament in Latin and French. In 1552 he also published 'Ad Censuras Theologorum Parisiensium, quibus Biblia à Roberto Stephano, typographo regio, excusa calumniose notarunt, eiusdem Roberti Stephani responsio.' This book, which was also published in French, gives us a clear insight into the nature of his disputes with the Sorbonne, as well as into his own character. The other works which he published during a period of seven years at Geneva are almost exclusively of a theological and controversial nature, consisting of works written by Calvin, Beza, and other distinguished reformers. He retained his former device, but under it he printed, 'Oliva Roberti Stephani.' The name of Geneva seldom appears on the title-page of his books. He died on the 13th of September, 1559, leaving behind him, it is said, a numerous offspring and considerable property. But only three of his sons are known, Robert II., Henry II., Francis II., and a daughter of the name of Catherine.

There is perhaps no man in modern times to whom literature and learning are more indebted than to Robert Stephens. His unbiassed contemporaries not only place him on a level with the greatest scholars, but declare that he excelled them all.

Charles Stephens appears to have been about a year younger than his brother Robert. His education was sound and classical; but he also applied himself to the physical sciences, and took his degree of doctor of medicine, which he practised for some time. He wrote several treatises on subjects connected with medicine, natural history, and agriculture, which however are less scientific than historical, for he treated his subjects chiefly in relation to antiquity. His earliest productions are abridgements of works by Lazarus Baifius, such as 'De Re Vestiaria;' 'De Vasculis;' and 'De Re Navali,' which were published by Robert Stephens (1535 and 1537). Lazarus Baifius (Lazare Baif) engaged Charles Stephens as tutor to his son, and in 1540 took him with his son to Germany, and afterwards to Italy, to which countries he was sent as ambassador of the king of France. In Italy Stephens became acquainted with Paulus Manutius, who in one of his letters (v. 17) speaks of him in high terms. On his return to Paris he appears to have continued the practice of medicine, but in 1551, when Robert removed to Geneva, the whole of his printing establishment, with the exception perhaps of the department for printing Hebrew, which appears to have been undertaken by Martinus Juvenis, passed into the hands of Charles Stephens, for the Editio princeps of 'Appiani Alexandrini Historiarum Romanarum Celtica, Libyca vel Carthaginiensis, Illyrica, Syriaca, Parthica, Mithridatica, Civilis quinque libris distincta,' which appeared at Paris in 1551, 'Cura ac Diligentia Caroli Stephani,' is probably the first book which he printed, though it had been prepared or commenced by Robert Stephens. It is a beautiful specimen of typography. There is a French translation of a treatise of Plutarch, called 'Traicté sur la Honte vicieuse,' by F. Legrand, which is by some referred to the year 1544, and is supposed to be the first book printed by Charles Stephens; but it probably belongs to the year 1554. Soon after Robert left Paris, Charles appears to have been appointed Royal Printer, for this title is mentioned on his last two publications of the year 1551. Henceforth he continued to be very active in his new sphere till the year 1561, for in these ten years there issued from his press 97 works, on a great variety of subjects, some of which he had written himself. Charles Stephens seems to have been a man who knew something of everything, but nothing very well. His character as a man has been attacked in a letter of Maumontius addressed to J. Scaliger, in which he is called a 'malus' and a 'male volens homo,' and is charged with unkind conduct towards his nephews, the sons of Robert. But as we hear of no accusations of this kind from any other quarter, the impartiality of the writer may be doubted. Charles Stephens died in the year 1564. Some say that he was persecuted for his religious opinions, and died in prison; others state that he was imprisoned for debt in the Châtelet, and that he remained there for the last three years of his life. It may be that both causes combined to bring this misery upon him; for we know that he lost a great deal of his capital in 1557, by the publication of his 'Thesaurus Ciceronianus,' which was a very expensive undertaking, and did not sell. It is also certain that during the last three years of his life no work appeared from his press. He left one daughter of the name of Nicole, who was no less celebrated for her beauty than for her talents and accomplishments.

Lists of the works which were written or printed by Charles Stephens are given by Maittaire and Renouard. We shall only mention the principal: 'De diversis Regulis Juris antiqui, Pandectarum libri quinquagesimi titulus xvii. et ultimus,' &c., Lutetiæ, 1552, reprinted in 1557; 'Dictionarium Latino-Gallicum, postrema hac editione valde locupletatum,' 1552, reprinted in 1570, fol.; 'Dictionarium Historicum ac Poeticum, omnia gentium, hominum, locorum, fluminum, ac montium, antiqua recentioraque, ad sacras ac profanas historias poetarumque fabulas intelligendas necessaria vocabula bono ordine complectens, cura ac diligentia C. Stephani,' Lutetiæ, 1553, 4to.; 'Philonis Judæi, de divinis decem Oraculis liber, Johanne Vacuræo interprete,' 1554, 8vo.; 'Prædium Rusticum, in quo cujusuis soli vel culti vel inculti plantarum vocabula ac descriptiones, earumque conserendarum atque excolendarum instrumenta suo ordine describuntur, &c.,' auctore C. Stephano, 1554, 8vo. This work has been translated into French, Italian, German, English, and Dutch. 'De Latinis et Græcis Nominibus Arborum, Fruticum, Herbarum, Piscium, et Avium, Liber; ex Aristotele, Theophrasto, &c., cum Gallica eorum nominum appellatione,' quarta edit., 1554; 'Latinæ Linguæ cum Græcâ Collatio ex Prisciano et probatissimis quibusque Authoribus per locos communes literarum, partium orationis, constructionis ac totius Grammatices,' auctore C. Stephano, 1554, 8vo.; 'Dictionarium Latino-Græcum, in quo singulæ Dictiones ac Locutiones Latinæ Græcis vocibus ac sententiis Præmissæ magnum utriusque linguæ commercium indicant,' &c., Parisiis, 1554, 4to.; 'M. Tullii Ciceronis Opera,' Paris, 1555, 4 vols. fol.; Caroli Stephani 'Thesaurus Ciceronianus,' Par., 1557. Stephens also compiled a 'Dictionarium Historico-Geographico-Poeticum,' which was printed after his death at Geneva in 1566, 4to., and was afterwards often reprinted in folio. N. Lloyd edited in 1670 an edition of it at Oxford, and in 1686 another was published in London. All the works of C. Stephens are very beautifully printed.

Henry Stephens II., the greatest of the whole family, was the son of Robert and grandson of Henry. He was born at Paris in 1528. Even as a child he showed most extraordinary talents. The numerous engagements of his father did not allow him to spend much time upon the education of the boy; but he carefully watched and regulated it. Latin he learnt naturally, as it was constantly spoken in the family, but before he seriously studied it the father made him learn Greek. He received his first instruction in Greek from a schoolmaster, who while reading the 'Medea' of Euripides with his boys, made it the practice to assign a part to each of them; and as soon as Henry had made sufficient progress to join them, he read this play with the greatest avidity, and soon knew it all by heart. After he had spent some time at this school, he was instructed in Greek by Petrus Danesius, who was then, next to Budæus, perhaps the ablest Greek scholar of the time; and who, on account of his intimate friendship with Robert Stephens, took great interest in the progress of his pupil. At the age of about fifteen Henry also enjoyed the instruction of Jacobus Tusanus (Jacques Toussain); and subsequently, when this scholar died (1547), that of Adrianus Turnebus, who succeeded Tusanus in the professorship of Greek in the Royal College. Although he had been chiefly instructed in Greek by these men, he did not neglect Latin; for even when a boy he is said to have known by heart the first book of Horace's 'Epistles.' He also studied mathematics; and as soon as he heard something of astrology, he conceived a strong desire to become acquainted with it, and having met with a young friend who entertained the same wish, the two boys began to take lessons. Henry did this without the knowledge of his father; but as the fees were very high, and the father, who thought that his son was taking lessons in mathematics, did not pay more than was necessary for mathematical

lessons, the boy persuaded his mother to make up the deficiency. In this way he wasted much money and time, but he soon became aware of the futility of these pursuits, and gave them up altogether.

In the year 1546 Robert Stephens thought his son qualified to assist him in his printing establishment, and in this year Henry collated a MS. of Dionysius of Halicarnassus, whose works Robert was preparing for publication. In the year following, when the death of Francis I. deprived Robert of his chief patron, Henry undertook a journey to Italy, the main object of which was to search the libraries and examine the manuscripts in that country. Three years were spent in visiting the various places of Italy. In several towns his exertions were rewarded with discoveries; at Florence he found in a MS. of the Medicean library a number of Greek poems not known before, which were the 'Epitaphia Homericorum Heroum.' He afterwards printed them in his 'Florilegium Epigram. Græc.,' 1566, and also in his 'Homeri et Hesiodi Certamen,' 1573. At Naples and Venice he examined several MSS. At Rome he was very kindly received by Cardinal Sirlet, who communicated to him a MS. of Athenagoras, and corrections of several passages in Xenophon, of which he subsequently made use in his edition of Xenophon, 1561. It appears that during this journey he also made a collation of a MS. of Athenaeus in the Farnesian library, the various readings of which he communicated to I. Casaubon, who used them in his edition of Athenaeus (1597). At the same time he made the acquaintance of the most distinguished scholars of the age, such as Muretus, P. Manutius, C. Sigonius, P. Vettori, Cardinal Maffeo, and many others. On his return, in the year 1549, he brought with him the treasures which he had discovered and collected. This was just at the time when his father was finishing his folio edition of the Greek Testament, for which Henry wrote sixty Greek verses which were prefixed to it. About the same time he wrote notæ and argumenta for the edition of Horace, which Robert published in 1549. In 1550 Henry Stephens set out on a journey to England, where he was kindly received by Edward VI. His stay was not long, but he appears to have paid great attention to everything that came in his way, and turned it to good account. He himself mentions some interesting circumstances connected with his visit to England in his 'Apologia pro Herodoto,' and in the preface to his edition of the 'Poetæ Heroici Græci.' On his return from England he visited Flanders, Brabant, and the university of Louvain (Loewen). It was at Louvain, as it appears, that he met with a Greek Anthology in MS. which was in the possession of an Englishman of the name of John Clements. From this he copied some verses which were afterwards inserted in his 'Florilegium.' From the same Clements he obtained one of the two MSS. which he used in his Editio princeps of Anacreon. During his short stay in the Netherlands, he made himself master of the Spanish language. On his return to Paris towards the end of the year 1551 his father was preparing to quit France, and it is not improbable that Henry accompanied him to Geneva. This is however not quite certain, for in 1554 we find him at Paris, where he published the Editio princeps of Anacreon, in 4to., with a Latin translation and notes by himself. Whether at this time he had a printing establishment of his own, or whether he printed his book in that of his uncle Charles, is uncertain, although the latter is more probable, for in the same year he edited 'Dionysii Halicarnassei Responsio ad Cn. Pompeii Epistolam,' &c., the title-page of which expressly states that it was printed by Charles Stephens. The first indication of a printing establishment belonging to Henry Stephens occurs towards the end of the year 1556, when 'Davidis Psalmi aliquot Latino Carmine expressi à Quatuor Illustribus Poetis, quos Quatuor Regiones, Gallia, Italia, Germania, Scotia, genuerunt,' &c. appeared, with the addition, 'Ex officina Henrici Stephani.' Towards the end of the year 1554 he made a second journey to Italy, and discovered at Rome a considerable part of the historical work of Diodorus Siculus, which had not then been printed, and which he afterwards inserted in his edition of 1559. In 1555 he went from Rome to Naples in search of something which appears to have been of importance to the king of France, and to his ambassador at Venice, Odet de Selve, but it is not stated what the object of his search was. The circumstance that the king of France was then at war with the emperor Charles V. brought H. Stephens into great danger at Naples, for he was here discovered by some Italian who had met him at Venice in the house of the French ambassador, and when Stephens was on the point of being arrested, he only saved himself by insisting upon his being an Italian, and he spoke the language so well that the Italian was at last persuaded, and let him go. On his return to Venice he rendered an account of his mission to the ambassador, who was well pleased with the manner in which he had executed his instructions. At Venice Stephens made a collation of a MS. of Diogenes Laertius in the library of St. Mark, which had originally belonged to Cardinal Bessarion, and which he used for his edition of Diogenes of 1570. He also examined two MSS. of Xenophon, one of which he made use of in his edition of 1561.

During the year 1557, when Stephens was in the full possession of a printing establishment, he published seven new works, some of which had never been printed before: among them are the Editio princeps of 'Maximi Tyrii, Philosophi Platonici, Sermones, sive Disputationes XLI., Graece, nunc primum editæ,' with a Latin translation; Æschylus, with notes by P. Victorius and H. Stephens; 'Ex Ctesia, Agatharchide, Memnone excerptæ Historiæ; Appiani Iberica. Item, de Gestis Annibalis: Græce. Omnia nunc primum edita, cum H. Stephani Castigationibus;' and 'Ciceronianum Lexicon Græco-Latinum,' &c. Henry adopted the emblem (an olive-tree) and the device of his father, 'noli altum sapere,' to which is sometimes added, 'sed time.' Another device of his which sometimes occurs is, 'ut ego insererer, defracti sunt rami,' which contains an allusion to the branches which are represented as engrafted upon the olive-tree. The travels of Stephens and the printing of expensive books had embarrassed his affairs, and after the year 1557 he found himself in great difficulties, but he was assisted by Ulrich Fugger, a wealthy merchant of Augsburg, who, besides a large sum which he gave or advanced to him, gave him an annuity of 150 thalers. Stephens from gratitude for this munificent liberality, henceforth called himself Typographus Huldrici Fuggeri, or Fuggerorum Typographus, which appears on most of his publications down to the year 1568. The Fuggers assisted Stephens also in other respects; they had an excellent library and some valuable MSS., which they allowed him to use for his editions of antient works, as in that of 'Imperatorum Justiniani, Justini, Leonis, Novellæ Constitutiones,' &c., Graece, the only work that he edited in the year 1558. After a series of years the Augsburg merchants appear to have become tired of supporting the great printer. In a collection of letters of Stephens, published by Passow in 1830, there are some which show that Stephens wanted them to advance him a small sum of money which they had promised, and that at length after much correspondence they did not keep their promise. In consequence of this his connection with the Fuggers ceased in 1576.

In the year 1559 H. Stephens published his edition of Diodorus Siculus in fol., in which ten books of this historian were printed for the first time. The MS. which he used for this edition is now in the public library of Geneva. Other publications of this year are, Appian's 'Hispanica et Annibalica,' with a Latin translation by Beraldus, in 8vo., and 'Gentium et Familiarum Romanarum Stemmata,' &c., in fol. In this year his father Robert died at Geneva, and Henry was appointed executor of his will, in which he was also enjoined to take care of his brothers. Robert, one of his brothers, had been, as it appears, disinherited by the father because he would not abandon the Roman Catholic faith and follow his father to Geneva. Accordingly the printing establishment of Robert, the father, came into the hands of Henry, who continued to publish theological works and several editions of the Bible. H. Stephens appears now to have given up his establishment at Paris, and to have devoted himself to the management of that at Geneva.

In the year 1555 H. Stephens married for the first time, but in 1564 or 1565 he himself states that his wife died. He afterwards married again, for the letters published by Passow show that about the year 1581 he became a widower a second time. On his death in 1598, he left a wife surviving, from which it appears that he was married thrice. By his three wives he had altogether 14 children, ten of whom died at an early age.

In 1560 he published a collection of the lyric poets of Greece with a Latin translation in 16mo., which has been often reprinted. In the year following appeared his edition of Xenophon in fol., for which he had collated a great number of MSS., and to which he added a commentary and

a Latin translation. An improved edition was published in 1581. During the last two years H. Stephens was in bad health and subject to melancholy, arising from over-exertion and the heavy cares that devolved upon him after his father's death. In this state he scarcely worked at all; he almost conceived a disgust for literary occupations, and could not bear the sight of a book. But the renewed activity into which he was drawn unconsciously in 1562, restored him to health. The work which roused him to fresh exertion was a Latin translation of 'Sexti Philosophi Pyrrhoniarum Hypotyposeon Libri Tres.' The Greek original of this work was not printed until 1621. It must have been soon after his recovery that Stephens began his greatest work, the 'Thesaurus Linguæ Græcæ,' upon which he spent ten years. In 1564 he wrote and published a 'Dictionarium Medicum, vel Expositiones Vocum Græcarum Medicinalium, ad Verbum, excerptæ ex Hippocrate. Aretæo,' &c., cum Latina Interpretatione, in 8vo. In this work he received some assistance from J. M. Gesner; it was highly spoken of by contemporary scholars, with the exception of Jos. Scaliger, who censured it severely, but he appears to have had a personal pique against Stephens. In this year Stephens edited a still-useful collection of 'Fragmenta Poetarum Latinorum, quorum Opera non extant,' &c., in 8vo., and an edition of Thucydides with the Scholia, and a Latin translation by L. Valla. In 1566 he published, among other books, his 'Florilegium' of Greek Epigrams; 'Poetæ Græci Principes Heroici Carminis et alii nonnulli,' &c., in fol., which is most beautifully printed, and his edition of Herodotus with Valla's translation and his own 'Apologia pro Herodoto,' which he himself afterwards translated into French. Passing over a great number of valuable publications which appeared from 1566 till 1572, we proceed to the year 1572, in which the Greek Thesaurus was published under the title 'Thesaurus Græcæ Linguæ ab Henrico Stephano constructus. In quo præter alia plurima quæ primus præstitit (paternæ in Thesauro Latino Diligentiæ æmulus) Vocabula in certas Classes distribuit, multiplici Derivationum Serie ad Primigenia tanquam ad Radices unde pullulant revocata,' with the appendix and index, 5 vols. fol. This work made an epoch in the history of Greek philology, as well as in the life of the author, who had embarked in it nearly all his property. The price of this prodigious work was necessarily high, and accordingly it could not have many purchasers. When Scapula some years afterwards published his cheap abridgement [SCAPULA], the sale was nearly stopped, and Stephens became involved in great difficulties. It has been supposed by some that Stephens soon after published a second edition of his Thesaurus, but this opinion has merely arisen from the fact that he cancelled a number of pages of the original edition, and inserted new ones in their place. In 1745 Daniel Scott published, in 2 vols. fol., 'Appendix ad Thesaurum ab H. Stephano constructum.' A new edition of the Thesaurus was published in London (1815-1828) in 7 vols. fol., with numerous additions by Barker, which however have not increased the value of the book. A new edition is now in course of publication at Paris, which is edited by Hase, and L. and W. Dindorf.

It appears to have been owing to the pecuniary difficulties in which Stephens was involved after the publication of his Thesaurus, that, in order to divert his mind, he made various excursions in France and Germany, but he always took the opportunity of exploring libraries and comparing MSS., and thus collected vast quantities of materials for works which he was publishing or projecting. In 1573 he published an edition of all the extant works of M. Terentius Varro in 8vo., and a collection of the fragments of the philosophical poets of Greece. The year following he produced an excellent edition of Apollonius Rhodius with the antient scholia and a commentary by himself. In 1575 there appeared his collection of the Greek orators, some of which are accompanied by a Latin translation; and Arrian's 'Expeditio Alexandri Magni,' &c. with a Latin translation. In 1577 he published, among other books, an edition of Cicero's 'Epistolæ ad Familiares,' in 2 vols. 8vo.; the second volume contains the commentaries of P. Manutius, Lambinus, Sigonius, Camer, and of Stephens himself. In the year 1578 he brought out his magnificent edition of Plato's works, in 3 vols. fol.; and in the same year he wrote a little French work, 'Deux Dialogues du Nouveau Langage François, Italianizé et autrement desguizé, principalement entre les Courtisans de ce Temps,' &c. (printed without name and date). This was an attack upon the fashion, very common at the time, of introducing Italian words into French. Stephens, after the MS. had received the 'imprimatur' from the state council of Geneva, had taken the liberty of making some additions, for which he was severely reprimanded by the council. Not thinking himself quite safe, or wishing to escape the annoyance to which this affair subjected him, he went, towards the end of 1578, to Paris, where he remained during the whole of 1579. Henry III. received him very kindly, and interested himself so much on Stephens's behalf, that he demanded of the council of Geneva permission for Stephens to return, and to clear himself from the charges which were brought against him. Stephens returned to Geneva, and was placed at the bar of the consistory, where he was treated with rigour and harshness, and for some days was put into prison. When Stephens at last owned that he had acted wrong, he was set at liberty.

During the stay which H. Stephens had made at Paris in 1579, he had a conversation with the king, in which he expatiated very ingeniously on the superiority of the French language over other modern tongues; and the king, delighted with this eulogy on the French language persuaded him to write a book on the subject. This book was published in the course of the same year, 'De la Precellence du Langage François,' Paris, 1579, 8vo. The king, pleased with the performance, ordered 3000 francs to be paid to Stephens from the public treasury, and also granted him an annual pension of 300 francs; but from the manner in which Stephens (in his 'Musa Principum Monitrix') speaks of this affair, it appears that he never received anything at all, for the treasurer at that time was a person of much more consequence in such matters than the king.

In 1581 Stephens published 'Juris Civilis Fontes et Rivi,' &c., in 8vo.; and, as is commonly supposed, also 'Sigonii Fasti Consulares.' The latter he printed without the sanction of the Council of Geneva, and was in consequence fined 25 thalers. This edition of the 'Fasti' of Sigonius, if it was really published by Stephens, must have been suppressed, for there is no trace of it now. H. Stephens spent the year 1585 again at Paris, where he published an excellent edition of A. Gellius and of Macrobius, both in 8vo. The former is preceded by a very interesting letter to his son Paul, from which, besides many other things, we learn that about this time his country-house had been destroyed by an earthquake, a loss which he bore with stoical indifference. In 1588 he published an edition of the Iliad and Odyssey, with a Latin translation.

During the time that Stephens enjoyed the friendship of the king of France, he spent a great part of his time at Paris. His publications during this period greatly decreased in number, and some of them were executed by Paris printers. His own establishment at Geneva was neglected. He was constantly travelling about, and he published his works wherever he happened to be, as at Paris, Frankfort, Basel, &c. From this fact it has been erroneously supposed that he had separate printing establishments in these places. He often resolved to give up this wandering life, and was seriously exhorted by his friends to attend to his business; but the charms of a court life and the habit of travelling had now become strong, and he was dazzled by splendour and deceived by the hopes which he placed in the great. The years 1588 and 1589 he appears however to have spent at Geneva, and several works again issued from his press; but in 1590 no work came out at Geneva, and only one ('Principum Monitrix Musa') at Frankfort, where he appears to have spent some time. In this year Henry III. of France was murdered. The affairs of Stephens now grew worse and worse: his warehouses were full of books which he could not sell. In the year 1597 he left Geneva for France. He first stayed for some time at Montpellier, where Florence, one of his daughters, resided, who was married to Isaac Casaubon. Casaubon was just preparing his edition of Athenæus, and Stephens offered his assistance, which was refused. He then proceeded through various other places to Lyon, where he was taken ill; and feeling solitary and forlorn, and having no friends there, he was carried to a public hospital, where he died, in the beginning of March, 1598, at the age of nearly seventy years. Some writers say that he died out of his mind, a statement which, if true, can only apply to the last few days of his life. It is a mistake to suppose that Stephens died in poverty because he died in an hospital; for the proceeds of his books alone,

which were publicly sold and fetched low prices, were sufficient to pay his creditors, and to leave something for his wife and children. Stephens died without a will; and Casaubon, who went to Geneva to receive his wife's dowry, which was still owing, together with her share of the inheritance, was generous enough to leave Henry's library, MSS., and printing establishment, in the hands of his son Paul.

There is no scholar to whom the Greek language and literature is under greater obligations than it is to Henry Stephens. He knew his superiority, and sometimes showed that he felt it. The number of books which he printed, edited, or wrote, is immense; and it is truly astonishing that, even during the rambling life of his latter years, he was continually producing new works. During the earlier part of his life he was a man of inflexible resolution, and never rested till he had effected his purpose; and he was always planning something, even to the last days of his life. He has often been censured for his alteration of passages in antient writers without being supported by the authority of MSS., and without even assigning a reason for his alterations. This has been said more especially in regard to his edition of Plutarch, which came out in the same year that he published his Thesaurus; but Wyttenbach, on examining several MSS. for his own edition, found that H. Stephens was in most cases supported by MS. authority.

Robert Stephens II., the youngest son of Robert Stephens I., and brother of Henry Stephens II., was born at Paris in 1530. The first time that we find him taking part in the publication of a work was in 1556, when he and Morel, who was then royal printer, published the edition of Anacreon prepared by H. Stephens. The title of royal printer was conferred upon Robert in 1561, as appears from some books printed by him in this year, at the same time that he came into possession of the printing-office of Charles Stephens. In this office he continued till his death. In activity and accurate and beautiful printing he was worthy of his father, but this is all that we know of him. As royal printer he was much employed in printing edicts and ordonnances, as may be seen from the list of his publications by Renouard. He died in 1571. Among his publications we only mention the following: a reprint of the Historical Dictionary ('Dictionarium Propriorum Nominum Virorum, Mulierum, Populorum, &c.') of Charles Stephens, 1560, 4to.; 'Josephi Scaligeri Conjectanea in M. Terent. Varronem,' 1565; and several editions of Donatus 'De Partibus Orationis.'

After his death his wife married again, and kept up the printing establishment. There are publications down to the year 1588, 'Ex officina Roberti Stephani.'

Robert Stephens III., son of Robert Stephens II, was educated by the poet and abbé Desportes, who inspired him with a love for poetry, and with whom he appears to have stayed at least till 1584. He did not commence printing till 1606, so that eighteen years elapsed without a publication appearing from the press of Robert Stephens. His first publication was, 'D. Gregorii Nysseni ad Eustathiam, Ambrosiam, Basilissam, Epistola, Græce. I. Casaubonus nunc primum publicavit, Latine vertit et notis illustravit,' Lutetiæ, 1606, 8vo. He probably worked in the printing establishment which had belonged to his father, and continued to print until 1631. He distinguished himself also by his Latin, Greek, and French verses, and by a French translation of the first two books of Aristotle's 'Rhetoric,' which was printed in 1630, 8vo. In his publications he generally added to his name the letters R. F. R. N., that is, Roberti Filius, Roberti Nepos, to distinguish himself from his father and grandfather. He printed a great number of books: the principal are, 'Menandri et Philistionis Sententiæ Comparatæ, Græce, ex Bibliotheca Regia; cum notis, cura N. Rigaltii,' Lutetiæ, 1613, 8vo.; 'D. Junii Juvenalis Satyrarum Libri v., Sulpiciæ Satyra, Cura Rigaltii, &c.,' Lutet., 1616; 'Dictys Cretensis, De Bello Trojano, et Dares Phrygius De Excidio Trojæ,' &c., 1618, 16mo.

There are several other members of the Stephens family of the name of Robert, but none of them were distinguished. During the last century there was a French writer of the name of Robert Stephens (Robert Etienne), who claimed a descent from the illustrious family of printers.

Paul Stephens, a son of Henry Stephens II., by his second wife, was born at Geneva in 1566. He received his early education at home, and was then sent out by his father to visit the principal towns of Europe, and the distinguished scholars with whom his father was acquainted. Lipsius, whom he visited at Leyden, was much pleased with him, and in one of his letters calls him 'mitis adolescens.' On his return to Geneva he assisted his father in printing and editing. He afterwards made several other journeys, partly perhaps in connection with the business of his father. In 1594 he spent some time in London, where, among other distinguished men, he made the acquaintance of John Castolius. In 1595 he was at Heidelberg, and in 1596 at Frankfort, where he stayed in the house of the jurist Dionysius Gothofredus. He had married in 1589. His first literary production was, 'Pauli Stephani Versiones Epigrammatum Graecorum Anthologiae, Latinis versibus,' Genevæ, 1593, 8vo. He was always fond of making Latin verses, but his poetry is stiff and unanimated. His best is perhaps the poem on the death of his father.

After the death of his father, when the affairs of the family were settled, and Casaubon had left Geneva, Paul was placed at the head of his father's printing establishment (1599), which he conducted with great energy. He first reprinted a number of classical authors which had been edited by his father, and were then out of print, such as Virgil, Horace, the letters of Pliny, and the Latin panegyrists and others. The two works which do him most credit are, 'Euripidis Tragœdiæ quae extant, cum Lat. Guil. Canteri Interpretatione,' &c., containing the Greek scholia and commentaries of several scholars, 1602, 2 vols. 4to.; and 'Sophoclis Tragœdiæ Septem, unà cum omnibus Græcis Scholiis et Latina Viti Windemii ad verbum Interpretatione,' &c., likewise containing the Scholia, and also notes by H. Stephens. In 1619 he printed a folio edition of Herodotus, founded upon that of his father, with a Latin translation and notes by Sylburg. No other publication issued from his press till 1626, when he published a fifth edition of the lyric Greek poets: 'Pindari et cæterorum Octo Lyricorum Carmina.' This was his last publication. The inactivity in his establishment during the last years appears to have been the consequence of his want of capital, to which we may perhaps also attribute the fact that most of his works are printed on very bad paper. In 1626 or 1627 he sold his whole establishment to the brothers Clouet. It is not known what became of him after this, and the time of his death is also unknown. He had eight children, two of whom only, Anthony and Joseph, survived their father.

Francis Stephens II., son of Robert Stephens I., and an elder brother of Henry Stephens II., followed his father to Geneva, and is said to have been a good Greek and Latin scholar. After the death of his father he established at Geneva a printing-office of his own, which he conducted from 1562 to 1582, with an interruption however of nearly ten years. Even during the remaining ten years he printed very few books, and most of them for publishers: this appears to have been owing to his want of capital. The first work, and almost the only one that he printed on his own account, was Calvin's 'Commentaries on the Psalms,' 1563, fol. His last publication was Amyot's French translation of the 'Moralia' of Plutarch, 1581-2, 2 vols. fol. After this time he gave up printing and settled in Normandy, and we hear no more about him.

Anthony Stephens, son of Paul Stephens, was born at Geneva in 1592. He studied at Lyon, and afterwards finished his education at Paris, where he abjured Protestantism before Cardinal du Perron. In 1612 he obtained letters patent of naturalization in France, and at the same time the office of huissier de l'assemblée du clergé, with a salary of 500 franks, which he held until the year 1635. Long before this time however he had been in the possession of a printing establishment. Some writers mention a work by Perron, which Anthony Stephens is said to have printed in 1605. But this cannot possibly be correct, as Anthony was then only thirteen years old. The earliest work which he printed belongs to the year 1613, and henceforth he conducted his establishment with an activity worthy of his great ancestors until the year 1664. He was also honoured with the title of royal printer, through the influence of Cardinal Perron, and he received a pension of 600 francs, but the time when he first received it is uncertain. The pension was stopped when Perron died, and Anthony after this was several times in great pecuniary difficulties. Among his numerous publications, which comprise all the works of Perron, there are several valuable editions of antient authors, such as Casaubon's edition of Strabo, 1620; of Plutarch's Works, with Xylander's translation, 1624, 2 vols. fol.; Leun-

clavius's edition of Xenophon, 1625; Aristotle's Works, 1629, 2 vols. fol.

For many years after the death of his patron Anthony was in very straitened circumstances, and was supported by his son Henry, who, from the year 1646, had a printing-office of his own, where, among other works, Montaigne's 'Essays' were printed. When this son died in 1661, and Anthony was deprived of his last and only support, he sank rapidly: he became infirm, and at last lost his sight. In this state he dragged on a wretched existence until the year 1674, when he died in the Hôtel-Dieu at Paris, at the age of 82. He had had six children, all of whom died before him.

Besides the members of the Stephens family, whom we have mentioned above, there are two more, who however were never engaged in printing. The one is Henry Stephens, a son of Robert Stephens II., who was treasurer of the royal palaces; the other likewise called Henry, and a son of the former, acquired some reputation as a poet, and also wrote some other works in French.

Respecting the lives of the Stephens, see Th. Jansonii ab Almeloveen, 'Dissertatio Epistolica de Vitis Stephanorum,' Amsterdam, 1685; Maittaire, 'Stephanorum Historia,' London, 1709, 2 vols in 4 parts, which contains a list, though not complete, of their publications; Greswell, 'A View of the early Parisian Greek Press, including the lives of the Stephani,' Oxford, 1833; Ant. Aug. Renouard, 'Annales de l'Imprimerie des Etienne, ou Histoire de la Famille des Etienne et de ses éditions,' Paris, 1837, 2 vols. 8vo. This last work contains in the first volume a very complete list of all the publications of the Stephens, and various interesting and important facts, derived from the public records of Paris and Geneva, which were unknown to former biographers.

STEPNEY. [MIDDLESEX.]

STEPNEY, GEORGE, descended from an antient family in Pembrokeshire, was born in the city of Westminster, in 1663. In 1676 he was sent to Westminster School, where he continued his studies till 1682, when he removed to Trinity College, Cambridge, where he distinguished himself in 1683 by a Latin ode on the marriage of the Princess Anne to Prince George of Denmark. He took the degree of M.A. in 1689. At Westminster he had formed a friendship with Charles Montague, afterwards earl of Halifax, which was continued at Cambridge. They came to London together, and were both introduced into public life by the earl of Dorset.

Stepney's life, which was short, was chiefly spent in diplomatic employments. In 1692 he was sent as envoy to the elector of Brandenburg; in 1693, to the emperor of Germany; in 1694, to the elector of Saxony. In 1695 he published a poem, dedicated to the memory of Queen Mary; in 1696 he went as envoy to the electors of Mentz and Cologne, and to the congress at Frankfort; in 1698 to Brandenburg, in 1699 to the king of Poland, in 1701 to the Emperor, and in 1706 to the States-General. He was made one of the Commissioners of Trade in 1697. He died at Chelsea in 1707, and was buried in Westminster Abbey.

Stepney's poems are few, and of little value. He was one of the 'eminent hands' who were united with Dryden in the translation of Juvenal in 1693. Johnson says "he is a very licentious translator, and does not recompense the neglect of his author by beauties of his own.'

(Johnson's *Lives of the Poets*; &c.)

STEPPES. [PLAINS.]

STERCORA'RIUS. [LARIDÆ, vol. xiii., p. 336.]

STERCU'LIA, a genus of plants which gives its name to the natural family of Sterculiaceæ, which sometimes forms a section of the family of Byttneriaceæ. The name is derived from *sterculus*, as that from *stercus*, some of the species being remarkable for the strong and disagreeable odour of their leaves or flowers. The genus is characterised by having polygamous or monœcious flowers. Calyx 5-lobed, somewhat coriaceous. Petals wanting. Stamens monadelphous, disposed in a short sessile or stipitate urceolus. Anthers adnate, ten, fifteen, twenty, in one or two rows; solitary or ternately aggregate. Ovary stipitate or sessile. Carpels follicular, five, or fewer from abortion, distinct, 1-celled, one or many seeded, opening on the inner side; seeds disposed in two rows along the suture of the carpels; sometimes, when the carpels have opened and become spread out, the seeds appear to be arranged along the sides of a leaf-like membrane. Seeds with fleshy albumen, and flat, leafy, equal cotyledons. The species consist of various-sized trees with soft timber, which are found in the tropical parts of the world, with simple or compound leaves and axillary panicles or racemes of flowers. Many of them are of considerable use in the countries where they are indigenous. Like the family to which they belong, several species are mucilaginous; and others yield fibre, which, from its tenacity, is made into ropes. Some yield a gummy exudation resembling tragacanth, and which is sometimes substituted for it: thus the gum called tragacanth, which is sometimes imported from Sierra Leone, is said by Dr. Lindley to be yielded by a species which he calls S. Tragacantha, the S. pubescens of others. So Dr. Roxburgh states *kuteera* gum, which is often substituted for tragacanth, to be produced by S. urens, a tree of the mountains of the Coromandel Coast. Dr. Royle however states that the kuteera gum of many parts of India is yielded by Cochlospermum Gossypium. S. guttata yields a bark, from which the natives of Malabar prepare flax-like fibres, of which the natives of Wynaad make a sort of clothing. S. acuminata is a native of the tropical parts of the western coast of Africa, where its seeds are everywhere known by the name of cola or kola, and are mentioned by most travellers. They are much esteemed by the natives, who take a portion of one of them before each of their meals, as they believe that these seeds increase the flavour of anything they may subsequently eat or drink. They are about the size of a pigeon's egg, are bitter in taste, and may be supposed to have some stomachic properties. The seeds of S. macrocarpa and of S. heterophylla are also called cola on the African coast. In Asia, in the same way, the seeds of S. Balanghas, are described by Rumphius as being roasted and eaten by the natives of Amboyna, while the capsules are burned for the preparation of the colouring-matter called *cassoumba*. The seeds of S. urens and of S. fœtida are likewise eaten in India after having been roasted, as are those of S. Chicha in Brazil. Those of S. alata are also said to be used as a cheap substitute for opium in the district of Silhet; but this statement, implying the presence of narcotic principles, requires careful examination before it can be received as a fact, as we generally find an accordance rather than so great a difference in the properties of species of the same genus.

STERCULIA'CEÆ, a natural order of plants belonging to the syncarpous group of polypetalous Exogens. The plants belonging to this order are trees or shrubs, with alternate, stipulate, simple, often toothed leaves, with a variable inflorescence, and a stellate pubescence. The calyx is either naked or surrounded with an involucre, consisting of 5 sepals, with a valvular or nearly valvular æstivation; 5 petals hypogynous, often saccate at the base; stamens definite or indefinite, and monadelphous; anthers 2-celled; the pistil consists of 5 carpels, often surrounding a columnar gynophore; fruit a capsule with 3 or 5 cells; seeds often winged, sometimes woolly; albumen oily or fleshy, and embryo straight; cotyledons either flat and plaited, or rolled round the plumule.

The order thus defined includes several groups of plants, which have by many writers been made to form distinct orders. Sterculiaceæ are most nearly allied to Malvaceæ, from which they differ in the possession of 2-celled anthers. From Dipteraceæ and Tiliaceæ, to which they are allied by the valvate æstivation of the calyx, they differ in the possession of monadelphous stamens. The subdivisions of this order are marked by very evident peculiarities of structure:—

Helictereæ have an irregular calyx and corolla.

Sterculieæ, no petals, and definite stamens placed at the end of a long column.

Bombaceæ, a calyx with a ruptile dehiscence, usually woolly seeds, and the cells of the anthers anfractuose.

Dombeyæ, a part of the stamens sterile and flat well-formed petals.

Byttnerieæ, a part of the stamens sterile, and small petals bagged at the base.

Lasiopetaleæ, a petaloid calyx and rudimentary petal.

Hermannieæ, spirally twisted petals with only 5 stamens, and those opposite the petals.

Sterculiaceæ are natives of India, New Holland, the Cape of Good Hope, and South America, with the West Indies. Most of its subdivisions have however a very definite geographical range.

Sterculieæ are found in India and equinoctial Africa. The genus Sterculia contains many species that are used as food or medicine. [STERCULIA.]

Byttneriеæ are principally natives of South America and the West Indies; about one-seventh of the species are found in the East Indies, and the same proportion in New Holland. To this group belongs the plant that produces the cocoa [THEOBROMA] of commerce. These plants, like the whole of the order and its allies, abound with mucilage, and are often used in medicine as demulcents. The fruit of *Guazuma ulmifolia* possesses a mucilaginous pulp, and is eaten in Mexico by man, but principally employed for feeding cattle. The bark of this plant is bitter, and is said to be serviceable in the horrible disease called Elephantiasis.

Hermanniеæ—two-thirds are found at the Cape of Good Hope; the remainder are natives of the East and West Indies, South America, and the islands of the Pacific. The species of *Waltheria* abound in mucilage, and are used in medicine as demulcents.

Dombeyæ are all African, East Indian, or South American. Their properties are similar to the preceding. One of the species, *Wallichia spectabilis*, forms a handsome tree, approaching the linden, and points out a relation between this order and Tiliaceæ.

Lasiopetalæ are found entirely in New Holland, and possess no remarkable properties. For further information on the properties of plants of this order see BOMBACEÆ, ADANSONIA, STERCULIA, THEOBROMA.

Sterculia chicha.

a, Branch with leaves and apetalous flowers; *b*, Monadelphous stamens surrounding pistil; *c*, Ovary, style, and stigma; *d*, Section of fruit, showing its 5 cells.

STEREOGRAPHIC. This word, which is derived from *στερεός*, 'solid,' and *γράφειν*, 'to draw,' and which therefore ought to be applied to every method of representing a solid in a plane, has nevertheless a limited technical sense, being applied to that projection of a sphere in which the eye is at a point in the sphere, and the plane of projection is the great circle of which the eye is at the pole, or a plane parallel to it. This mode of projection was known to Hipparchus, and was first described in the work on the planisphere attributed to Ptolemy.

The stereographic projection has two remarkable properties. The first is, that all circles are projected either into straight lines or circles. Those which pass through the eye are of course projected into straight lines; in every other case the projection is the SUBCONTRARY section of a cone, which has its vertex at the eye, and the circle to be projected for its base; consequently the projection is a circle. As much of the circle as lies below the plane of projection (the eye being considered as above it) is projected inside the great circle on which projection is made; and all the rest outside: when this projection is employed in maps, it is usual to place all the part of the globe to be projected below the plane of projection.

The second property is, that the angle made by two circles which meet on the globe, is equal to the angle made, at the point of meeting, by the two circles which are the projections of those circles, the angle made by two intersecting circles on the globe being always that made by their tangents. This property is easily proved as follows: Draw through the point of intersection of the two circles (A and B) which are to be projected, two other circles (A′ and B′), which have the same tangents, and pass through the eye. Then the tangents of A′ and B′ at the eye make the same angle as those at the other point of intersection; that is, as the tangents of A and B at the point to be projected. But these tangents of A′ and B′ at the eye are parallel to the *projections* of the tangents of A and B at the point to be projected: whence the projections of these tangents of A and B make the some angle as the tangents themselves.

The first property was known to Hipparchus and Ptolemy: the history of the second is rather curious. The first writer who seems to have looked attentively for a discoverer was Delambre (*Mém. Inst.*, vol. v., p. 393), who could not find it in Clavius, Stoffler, or any of the writers of the middle ages, who have treated pretty voluminously on the astrolabe, which word, as used by them, merely meant a stereographic projection. That it was mentioned (without demonstration) in the French Mathematical Dictionary of Savérien (1753), in an article which was copied word for word into the 'Encyclopédie,' was all that Delambre could then say of its origin. He afterwards, in writing his *History* of Astronomy in the Middle Ages, found the proposition demonstrated in the 'Compleat System of Astronomy,' by Charles Leadbetter, London, 1728; but, judging from the rest of the work, he presumes that Leadbetter could not have been the discoverer. No claim however has been put in for any one else, and we think it somewhat of an additional presumption in favour of Leadbetter that Savérien's article, which, appearing in the 'Encyclopédie,' first called general attention to the property, can be traced to Leadbetter's work nearly. For we find that Savérien translated his article, word for word, from the second edition (1743) of Stone's 'Mathematical Dictionary.' Stone was a contemporary of Leadbetter, and several times refers to his writings. In any case, however, until another inventor can be shown, the last-named mathematician must not be deprived of his right because he does not appear to have done other things as remarkable as this one.

The consequence of Leadbetter's theorem is, that any small portion of the sphere is projected into a figure very nearly similar to itself, so that any not very large portion of the earth preserves its figure with tolerable accuracy in the map. Hence some writers have said that there is no distortion in the stereographic projection, which is not absolutely true, though nearly so of countries which bear no greater proportion to the whole earth than most of them.

The mode of laying down the stereographic projection, which we cannot here give at length, may be found in the memoir of Delambre above cited, in the work on Practical Geometry published by the Society for the Diffusion of Useful Knowledge, or in any work on the construction of maps.

After correcting the proof of the preceding, we had occasion to consult the third edition of Dr. Harris's 'Lexicon Technicum' (1716); and feeling sure, with regard to that work, that such a proposition as the one called Leadbetter's would be stated, if it were then known, we turned to the article 'Spherick Geometry,' and there we found it, with a demonstration, enunciated as follows:—'All Angles made by Circles on the Superficies of the Sphere are equal to those made by their Representatives on the Plane of the Projection.' The claim of Leadbetter is therefore overthrown. In the preface, Harris says that under (among others) 'Spherical Geometry' will be found entire treatises, which, if he mistakes not, are as short and plain as any extant. If this proposition had been new, he would probably have

noted it here, particularly if it had been his own. We find however, finally, that the property was lately shown (*Encyc. Brit.*, 'Projection') to have been demonstrated by Halley in No. 219 of the 'Philosophical Transactions,' and is attributed by him to De Moivre or Hook.

STEREOTOMY. [PERSPECTIVE.]

STEREOTYPE. The art of stereotype printing is the printing from cast plates of type-metal in lieu of moveable letters or types, and derives its name from the Greek στερεός, firm or fixed, and τύπος, a figure or type. This art is a remarkable illustration of the tendency of some inventions to return, after a long course of improvement, very near to their original simplicity. In the commencement of the art of printing, solid blocks of wood were used, containing, in one piece, all the words of which a page was composed. A great improvement upon this plan was the use of single letters or types, which might be combined into words and pages, and, after being printed from, might be distributed and re-arranged for another work. Then followed the process of type-founding, or casting the letters individually in moulds, by which they might be multiplied with facility, and, being engraved originally upon steel punches, might be executed with greater neatness. Whether the early printers employed logotypes, that is, types for printing whole syllables or words, to any material extent, is not very certain; but it is well known that many persons have proposed, since the introduction of moveable types, the use of such logotypes for the purpose of facilitating the operation of printing; while others have adopted processes which approach more nearly to the old plan of printing from page-blocks, either by fusing the types composing a page into a solid mass, or, as in the modern art of stereotyping, by taking a mould from the page or *form* of moveable types, and using it as the matrix in which to make a solid cast or plate of metal. The face of such a cast is a fac-simile of the types from which the mould is taken, and may be printed from in the same manner as the original form or page.

Many of the accounts of the various projects which bear an affinity to the art of stereotyping, as practised by modern printers, are very indistinct; and the claims of some of the projectors are exceedingly perplexing. Those readers who desire minute information may consult works which enter at length into the history of printing, and especially a very interesting 'Essay on the Origin and Progress of Stereotype Printing,' published in 1820 by Mr. Hodgson, of Newcastle. The subject is also treated at considerable length in Hansard's 'Typographia;' but much of the history contained in that work is derived from the volume before mentioned.

One of the earliest schemes which claims notice in this brief sketch is that which was tried at the beginning of the last century by a Dutchman named Van der Mey. The booksellers Luchtmans, of Leyden, in a letter dated 1801, which was printed by M. Camus, in his 'Histoire et Procédés du Polytypage et de la Stéréotypie,' described some plates or blocks formed by Van der Mey, which had been used in their establishment ever since 1711. These were the forms for a quarto Bible; but a few other works were executed in the same way. They were not cast solid, but consisted of ordinary types, which, after being set up in the usual way, were converted into a solid mass by soldering them together at the back. The great expense of forms prepared in this way, as well as their inconvenient weight and bulk, is quite sufficient to account for the plan having fallen into disuse. It was indeed only applicable in those very rare cases in which it was desirable, in order to meet a constant demand, to keep the forms of type standing; and was preferable to that practice only inasmuch as it avoided the risk of some of the letters being accidentally loosened and misplaced.

William Ged, a goldsmith of Edinburgh, if not absolutely the first, was one of the first to practise stereotyping, according to the common acceptation of the word. His claim to this honour is recorded in a rare pamphlet published by Nichols in 1781, and reprinted in 1819 by Hodgson of Newcastle, entitled 'Biographical Memoirs of William Ged, including a particular account of his progress in the art of Block-printing.' From this work it appears that Ged invented a process for casting whole pages about the year 1725, and that a few years afterwards he and others who were associated with him attempted to apply his invention to the production of bibles and prayer-books for the university of Cambridge. One of the difficulties to be encountered in the introduction of this innovation was the prejudice and opposition of the compositors, who, by the artful production of errors in the forms of type, rendered the casts so incorrect as to bring them into discredit. The scheme was abandoned by the University, and most of the plates were destroyed. A battered and otherwise imperfect specimen which escaped the melting-pot is printed in Hansard's 'Typographia.' Ged cast plates for a few other works; one of which was an edition of Sallust, in 18mo., which, according to his son and daughter, was executed in 1736, though Hodgson says that he never saw a copy dated earlier than 1739, and that the edition commonly bears the date 1744. In Hodgson's Essay a page of this work is reprinted, which is a far better specimen of stereotyping than that given by Hansard. This plate, which had been previously printed in the tenth volume of the 'Philosophical Magazine,' is about a quarter of an inch thick.

About the year 1780, Mr. Tilloch, editor of the 'Philosophical Magazine,' conceived the possibility of founding whole pages; he being, at that time, unacquainted with the prior experiments of Ged. He communicated his idea to Foulis, printer to the university of Glasgow; and they jointly produced several works; some of which were circulated without any intimation of the process by which they were printed. Hodgson gives very good specimens of their work. Finding some inconvenience in the use of blocks of wood for mounting the plates, in order to raise them to the same height as type, these experimentalists tried blocks of brass, having slits through which small screws might pass to secure the stereotype plates; the screws being fastened by nuts on the under side of the brass mounts. In order to bed the plates as evenly as possible, whether the mount were of brass or wood, they interposed a layer of cement between the plate and the mount. In the latter case the thickness and level were adjusted by planing the back or under side of the wood; and in the former by warming the mount, and then placing it, with the plate, into a press, and squeezing out the superfluous cement. An account of the experiments of Tilloch and Foulis was published in the tenth volume of the 'Philosophical Magazine.' Satisfactory as they were, they did not immediately lead to the adoption of stereotype printing.

Towards the latter end of the eighteenth century, many projects were brought forward in France for multiplying engraved blocks or forms of type by processes more or less resembling that of stereotyping, under the names of polytype, stereotype, &c. In some of these the form was imitated by striking upon a mass of soft metal in a state intermediate between perfect fusion and perfect solidity, on the principle of the process now practised in France under the name of *clichage*. The extensive issues of assignats by the revolutionary government gave an impulse to such schemes, of which many were devised, and some were brought into operation, in order to render the assignats more difficult of imitation. In 1798 a stereotype edition of Virgil was published by the Didots and M. Herman; and it appears from Hodgson that, before the close of the century, the wood-engravers of Paris sold metal casts of their wood-cuts.

Some of the early experiments of Senefelder, the inventor of lithography [SENEFELDER, vol. xxi., p. 229] were directed to the discovery of a means of stereotyping by which he might be enabled to print his own works with a very small stock of type. He formed a composition of clay, fine sand, flour, and pulverised charcoal, mixed with a little water, and kneaded as stiff as possible; and with this paste he made a mould from a page of types, which became, in a quarter of an hour, so hard that he could take a very perfect cast from it in melted sealing-wax, by means of a hand-press. He states that, by mixing a little pulverised plaster of Paris with the sealing-wax, the stereotype plates thus produced were much harder than the common type-metal of lead and antimony. The want of pecuniary means for carrying on this project led him to abandon it, and to contrive a plan for printing from stone. Another ingenious proposal which may be here mentioned, is that of Professor Wilson, of Glasgow, who, in 1797, devised a method of multiplying engraved blocks or plates by stereotype or rather polytype impressions in glass or enamel, which, it was anticipated, would prove very durable, and might be applied with advantage to the prevention of forgery. Hodgson gives specimens of two casts of small wood cuts produced in this manner.

The revival and introduction into common use of the ste-

reotyping process is, in a great measure, due to the exertions of Earl Stanhope, about the commencement of the present century. Mr. Tilloch communicated to him the result of his experiments, and Foulis, who, as before stated, had been associated with Tilloch, assisted in the trials made at his lordship's seat at Chevening, in Kent. Andrew Wilson also was connected with these operations, and exerted himself much to introduce the process. The latter individual, who received a gold medal from the Society of Arts in 1810, for his 'great skill and exertions in stereotype printing,' produced several important stereotyped works, of which Hodgson considers his edition of Walker's 'Pronouncing Dictionary,' executed in 1809, to be the best. A specimen of his work, which was printed in the twenty-eighth volume of the 'Transactions' of the Society of Arts (pp. 323-4), shows that he was then able to produce very good casting from type as small as Nonpareil and Pearl. In 1803 or 1804 the process which had been perfected at Chevening was communicated to the university of Cambridge, and shortly afterwards to that of Oxford; but the first work printed in this way at the former place did not appear until 1807, and 1809 is the date of the earliest stereotyped book issued at Oxford.

In setting-up a form intended for stereotyping from, the *spaces*, or short pieces of metal by which the words are separated from each other, and the *quadrats*, or larger spaces by which blank lines are filled up, are cast higher than usual. The types are set up and formed into pages in the usual manner, with the illustrative wood-cuts, if there be any; but, instead of these pages being arranged into a form of sufficient size to print a whole sheet, each page, if large, or every two or four pages, if small, is separately locked up in a small frame or *chase;* the pages being surrounded by fillets of wood or metal, which serve in the cast to form a border for attaching the plate to its mount. The face of the types is then moistened with oil, to prevent the mould from adhering to them. A brass frame, rather larger than the page, is laid upon the chase, in order to retain the plaster while in a fluid state, and to regulate the thickness of the mould. The plaster is then poured on the types, and it soon sets into a solid mass, which must be removed from the types with great care, trimmed on the edges with a knife. The plaster moulds are, in the next place, baked in an oven heated to about 400° Fahrenheit, until they are thoroughly dry and hard. They are placed upright in a rack, and are usually dried in about two hours. Great care is required in this process, especially when the moulds are large, to prevent them from warping.

After being baked, the mould is placed, with its face downwards, upon a smooth plate of iron, called a *floating-plate*, which lies at the bottom of a cast-iron box rather larger than the mould. The box is then covered in by a lid, the under surface of which is made perfectly flat, and which has the corners cut off, to allow the melted metal to enter the box. The cover is firmly held down by a screw, which is attached to an apparatus by which the box is suspended from a crane. It should be observed that the casting-box and plate are heated to the same temperature as the mould, before it is inserted. The box is then swung by the crane over the metal-pit, which is an open iron vessel containing a large quantity of melted metal, resembling in its composition that used for casting types; and it is lowered into the metal in a nearly horizontal position, being a very little inclined, to facilitate the escape of air from the mould and box. The melted metal runs in at the corners of the box; and, by its greater specific gravity, floats up the plate with the mould, forcing the latter tightly against the lid of the box. By this contrivance the metal is forced, by hydrostatic pressure, into every part of the mould; in the margin of which notches are cut to allow free passage for the metal between it and the floating-plate. After remaining immersed in the metal for about ten minutes, the box is gently raised, and removed by the crane to a trough in which its lower part is rapidly cooled by contact with cold water. While the box is cooling, the caster pours in a little metal at the corners, to fill the space left by the contraction of the metal, and so to keep up the necessary pressure upon the cast. When cold, the contents of the box are removed in a mass, from which the superfluous metal is broken off by blows from a mallet. The plaster mould is then broken away from the cast, the face of which is a fac-simile of the types and engravings from which the mould was taken. As the mould is destroyed by this process, it is necessary, when several stereotype plates of the same page are required, to take a distinct plaster mould for each.

The above is the mode of casting usually practised in England; but a different plan has been successfully adopted by Mr. Allen of Edinburgh. The pages of the seventh edition of the 'Encyclopædia Britannica' are stereotyped by the new process alluded to, which is minutely described in the article 'Printing' in that work. The casting-box is, in this case, of sufficient depth to receive several moulds in a vertical position, so that, of the work just alluded to, five pages are cast simultaneously. Another plan which has been tried for the production of stereotype plates too large for casting in the ordinary way, but which we believe has not proved very successful, is to place the mould in a flat iron box, having a trough-shaped mouth at one end, and to pour in the metal with the mould-box, which must be previously heated, in an inclined position. The method of striking the moulds, and from them the plates themselves, by letting the original or pattern types or blocks fall upon a mass of soft metal in a half-melted state, is practised in France, and has been repeatedly tried in this country: it is especially adapted for the production of copies of wood engravings, but it is very liable to injure a delicately engraved block. In this, as in the ordinary casting process, the original engraved blocks should be smeared with some substance that may prevent the cast from adhering to them. In the 'Treatise on Wood Engraving' by Messrs. Chatto and Jackson, a composition of common yellow soap and red ochre is recommended for this purpose.

The alloys used for various kinds of stereotyping differ slightly in their composition, but generally consist of type metal. [TYPE FOUNDING.]

In the year 1820 Mr. (now Sir M. I.) Brunel patented a method of stereotyping intended chiefly for newspaper work, which, though not brought into operation, may afford a useful hint. He proposed to form a mould of a composition of pipe-clay, chalk or burnt clay, finely powdered, and starch, mixed up with water into a stiff paste, and spread upon a thin and flexible plate of steel. The paste was then to be covered with several thicknesses of fine calico, and a skin of wet parchment, and pressed upon the types, to squeeze it into the general form. After this the calico and parchment were to be removed, and two sheets of paper placed in their stead; the mould then received another pressure, by which it was rendered more like the face of the types. Finally, the papers were to be removed, and the impression perfected by pressing the mould immediately upon the surface of the types, which should then be smeared with oil. From this mould a cast was to be taken in metal for printing from. By the proposed application of this process to newspaper printing it was conceived that time might be saved by printing in duplicate, or by bending the plates on to the surface of a cylinder, by which means they might be printed from more rapidly than when flat. By another plan mentioned in the same patent, a kind of stereotype plate was to be formed of shell-lac, spread upon a plate of iron, and coated with a thin film of type-metal. These plans are more fully described in Hansard's 'Typographia.'

Stereotype-plates need careful examination and *picking*, to remove the imperfections in the casting. Small hollows, such as the loops of an a, an e, or an o, are liable to be filled up with metal, owing to blebs of air in the mould, and the fine white lines in wood-engravings are sometimes filled up. Such matters should be corrected by the picker, who should also cut down, with suitable tools, such blank spaces as might be liable to soil in printing. Before printing, also, defective letters or words which cannot be corrected by the picker should be cut away, and types inserted in their place. These types are soldered into holes drilled through the plate; their stems being sawn off flush with the back.

Although the plates are cast of as equal a thickness as possible, they require, before printing from, to be accurately flattened at the back by means of a peculiar kind of lathe, in which a steel cutter, or *knife*, mounted in a slide-rest, shaves off the metal from the back of the plate in concentric circles, until it is made perfectly even. They are then mounted upon blocks of wood or metal, to raise them to the same height as common types. The tendency of wood to warp when exposed to changes of temperature, or to occasional wetting, has led to many projects for mounting stereotype-plates upon blocks of cement, or upon metallic mounts which might be applicable to plates of various sizes. When wooden blocks are used, the plates

are usually secured to them by clips at the edges, and sometimes by screws.

The process of stereotyping is one of the most important means by which the production of cheap books has been facilitated of late years. For a work of limited and temporary demand it is unnecessary; but where the demand is very great, and likely to last for several years, it is all-important, since it enables the publisher to keep up the supply without the expense of having a very large edition printed at once. In most cases where the demand is uncertain, and in almost all where the demand is sure to be large, it is desirable to resort to stereotyping, because, although it increases the first cost of production, it enables the publisher to avoid, on the one hand, the risk of printing a great number of copies which may prove unsaleable, and, on the other, the outlay necessary for the re-composition of the types, in case the demand should exceed the number of copies first printed. For instance, for a work now preparing for publication in demy octavo, the estimate stands as follows:—

Composing, per sheet	.	.	£3 10 0
Corrections, per sheet	.	.	2 0 0
			£5 10 0

The extent of the sale is very uncertain, so that, without the aid of stereotyping, the publisher must either run the risk of printing a long number, or incur the repetition of this expense of 5*l*. 10*s*. per sheet, if the sale should outrun the first edition. In case of reprinting, the same difficulty would occur as to the number which might be required, as the forms of type must be immediately distributed, and therefore the extent of the impression must again be a matter of hazard. All this uncertainty may be avoided by stereotyping the forms, which will occasion an increased outlay, in the first instance, of 2*l*. 2*s*. per sheet. A small number of copies may then be printed, and, if the demand should continue, re-issues of a few hundreds each may be made at the mere cost of paper and press-work, and without the delay and risk of error consequent upon re-composition. The 'Library of Useful Knowledge,' and several other works of the Society for the Diffusion of Useful Knowledge, present striking examples of the advantages alluded to, since, although the demand has been very large and long-continued, and the number of copies sold of some works has greatly exceeded that of others of the same series, the supply has never been interrupted, nor has the expense of re-composition ever been incurred. In cases where great numbers are required at once, stereotyping has been found very useful, since two or more sets of plates may be made, and printed from simultaneously. Its advantages have been particularly felt in the production of the 'Penny Magazine,' and similar works. (See *Penny Magazine*, No. 107, for a fuller enumeration of them.) 'Chambers's Edinburgh Journal' is another remarkable instance of the utility of this process; since it enables the publishers to print their London edition in London, by merely sending eight stereotype plates from Edinburgh every week, instead of having to send many thousand printed copies, at a much greater expense.

It has often been urged as an objection to stereotype printing that it tends to perpetuate errors; but the fallacy of such a statement may be easily shown. In re-composition new typographical errors are pretty sure to arise, while the expurgation of old ones is by no means certain; but in stereotype plates the occurrence of new errors (excepting by the breaking off of a letter or figure) is impossible, and original errors may be altered whenever they are discovered. Such alterations are not necessarily confined to the insertion of a letter or a word; for whole sentences and paragraphs may be altered in like way, provided that the new matter be made the same in extent as that which is cut away. Hence a stereotyped work may be gradually rendered almost immaculate; and an error which would otherwise have run through the whole edition, may be corrected when only a few hundred copies have been circulated.

The multiplication of engravings is an object of little less importance than that for which stereotyping is more extensively used. By the help of this art copies of the wood-cuts in the 'Penny Magazine' and other works are supplied, at a very moderate cost, to publishers in America and on the Continent. This diffusion of engravings has been carried to such an extent, that casts of some illustrations executed for British periodicals have been transmitted to as many as seventeen different countries, for use in similar works.

STERLING, a word applied to all lawful money of Great Britain. In Ruding's work on 'Coinage,' vol. i., p. 13, 4to. edit., the various supposed derivations of the word are given, with a list of the old writers who have adopted each. Ruding himself, after an elaborate examination, says, 'its origin and derivation are still unsettled;' but he inclines, with the majority of the authorities, to attribute it to an abbreviation of Esterlings, people of the north-east of Europe, some of whom were employed in the twelfth century in regulating the coinage of England. The word was not in use before the Conquest, though some have given it a Saxon derivation. In the twelfth century its use was common, and in the following century a writer ascribes its origin to the Esterlings. From the twelfth century English money was designated all over Europe as sterling. By the statute called the Assize of Weights and Measures, which is attributed, in some copies, to the reign of Henry III. (1216-1272), in others to that of Edward I. (1272-1307), 'the king's measure was made so that an English penny, which is called the sterling, shall weigh thirty-two grains of wheat dry in the midst of the ear.' This is the origin of the pennyweight, though it now weighs twenty-four grains.

STERN. [SHIP.]

STERNA. [TERN.]

STERNASPIS. [TESTUDINATA.]

STERNE, LAURENCE, was the great-grandson of Dr. Richard Sterne, who died archbishop of York in 1683. His father, Roger Sterne, second son of Simon Sterne of Elvington and Halifax, having entered the army, became a lieutenant in Handaside's regiment, and on the 25th of September, 1711, o.s., married in Flanders, Agnes, the widow of Captain Hebert, and stepdaughter of a person of the name of Nuttle, whom Sterne himself, in a memoir written for the information of his daughter a short time before his death, describes as 'a noted sutler in Flanders in Queen Anne's wars.' His mother's own family name he professes to have forgotten. Roger's first child, born at Lisle, in July, 1712, was a daughter, Mary, who grew up to be a very beautiful woman, but made an unfortunate marriage, and died early of a broken heart: Laurence was brought into the world, on the 24th of November, 1713, at Clonmel in Ireland, where his father and mother had arrived with the regiment from Dunkirk only a few days before. 'My birthday,' says Sterne, 'was ominous to my poor father, who was, the day after our arrival, with many other brave officers, broke, and sent adrift into the world, with a wife and two children.' The lieutenant upon this betook himself with his wife and family to the family seat at Elvington, near York, where his mother, who had inherited the property from her father, Sir Roger Jaques, resided, her husband having died ten years before; here they all sojourned for about ten months, after which, the regiment being re-established, they set out to join it at Dublin, whence, lieutenant Sterne being within a month ordered to Exeter, his wife and her two infants followed him thither. They remained a twelvemonth in England, and then the lieutenant, with his family increased by another boy, born at Plymouth, was forced once more to turn his face to Ireland. This must have been about the end of the year 1715, if the chronology of the account is to be depended upon. Having got to Dublin, they continued there till the year 1719, which however would be for above three years, instead of only a year and a half, as Sterne seems to state. In that year, he says, 'all unhinged again.' The regiment was ordered to the Isle of Wight, to embark for Spain on the Vigo expedition. On their journey thither from Bristol the younger boy died, but his place was supplied by a girl (who died however in childhood) born in September, 1719, in the Isle of Wight, where the lieutenant left his wife and children till the regiment got back to Wicklow, in Ireland, whither he then sent for them. They lived a year in the barracks at Wicklow, where Mrs. Sterne gave birth to another boy; and then they spent six months with a relation of hers, a Mr. Fetherston, parson of a place called Animo, about seven miles from Wicklow. 'It was in this parish,' says Sterne, 'during our stay, that I had that wonderful escape, in falling through a mill-race whilst the mill was going, and being taken up unhurt; the story is incredible, but known for truth in all that part of Ireland, where hundreds of the common people flocked to see me.' The incident, it seems, is still traditionally remembered in the district,

After this they were in barracks for another year in Dublin—the year 1721—in which, Sterne tells us, he learned to write. The regiment was next ordered to Mullingar, where a collateral descendant of archbishop Sterne found out his relations, or was found out by them, and, taking them all to his 'castle,' entertained them kindly for a year, and then sent them after the regiment to Carrickfergus. On the journey thither, which took six or seven days, and is described as 'most rueful and tedious,' the youngest boy died, and also another infant, a girl, which had been born when they were last in Dublin. In the autumn of this year (1723), or the spring of the next, the subject of the present article, now ten years old, was sent over to England, and put to school, near Halifax, 'with an able master,' says he, 'with whom I stayed same time, till, by God's care of me, my cousin Sterne of Elvington became a father to me, and sent me to the University.' It will be perceived from this detail, that, although Sterne was of English descent and parentage, he was not only by accident a native of Ireland, but spent in that country a considerable part of his early boyhood. No doubt some effect was produced upon his opening powers of thought and observation, by his having been allowed to run wild, as it were, in that land of wit and whim from his seventh to his tenth year.

His father next followed his regiment to Londonderry, 'where,' says the autobiographical sketch, 'another sister was brought forth, Catherine, still living, but most unhappily estranged from me by my uncle's wickedness and her own folly.' From Londonderry the regiment was sent out to defend Gibraltar at the siege (in 1727), where Lieutenant Sterne was run through the body by a brother officer in a duel, and only recovered with much difficulty, and with so shattered a constitution, that when, shortly after, he was sent out to Jamaica, he speedily fell a prey to the country fever, dying at Port Antonio, in March, 1731. 'My father,' says Sterne, 'was a little smart man—active to the last degree in all exercises—most patient of fatigue and disappointments, of which it pleased God to give him full measure; he was in his temper somewhat rapid and hasty, but of a kindly, sweet disposition, void of all design, and so innocent in his own intentions, that he suspected no one; so that you might have cheated him ten times in a day, if nine had not been sufficient for your purpose.'

Meanwhile Sterne remained with his master at Halifax, to whom, from an anecdote which he relates, his dawning genius seems to have been already clearly discernible, till he was sent by his kinsman to the University of Cambridge in 1733. He was admitted of Jesus College on the 6th of July in that year; and he took the degree of B.A. in January, 1736; and that of M.A. at the commencement in 1740. On leaving the university, in what year has not been stated, he took orders, and his uncle, the Rev. Jaques Sterne, LL.D, a younger brother of his father's, and a well-beneficed clergyman, being a prebendary of Durham and of York, and rector of Rise and of Hornsea cum Riston, procured him the living of Sutton, in Yorkshire. It was in the city of York that he met with the lady whom he married in 1741, after having courted her, as he tells us, for two years. Her name is not known; all that appears is that her Christian name began with L., being probably Lydia, like that of her daughter. She brought him some fortune, but probably of no great amount. Sterne's uncle now procured him a prebend in York cathedral; 'but he quarrelled with me afterwards,' says Sterne,' 'because I would not write paragraphs in the newspapers: though he was a party man, I was not, and detested such dirty work, thinking it beneath me: from that period he became my bitterest enemy.' Notwithstanding all this virtuous indignation however, Sterne appears to have gone on doing this 'dirty work' for his uncle for a very considerable length of time—not much less than twenty years. In a letter to a Mrs. F——, written in November, 1759, on the eve of the publication of the first two volumes of his 'Tristram Shandy,' he says, in reply to an inquiry his correspondent had made as to the reason of his turning author, 'Why, truly, I am tired of employing my brains for other people's advantage. 'Tis a foolish sacrifice I have made for some years to an ungrateful person.' It has been asserted that he wrote, or conducted for some time, a periodical electioneering paper published at York in the Whig interest. Soon after his marriage, a friend of his wife's presented him with the living of Stillington, also in Yorkshire; and he tells us he remained near twenty years at Sutton doing duty at both places, which seem to have been within a mile and a half of each other: 'I had then,' he says, 'very good health: books, painting, fiddling, and shooting were my amusements.' During all this space, his only publications, or all at least to which he put his name, were two sermons: the first, entitled 'The Case of Elijah and the Widow of Zarephath considered,' in 1747; the second, entitled 'The Abuses of Conscience,' in 1750. This latter is the same which he afterwards introduced in the second volume of his 'Tristram Shandy' as a Sermon of Yorick's: in the preface to the two first volumes of his collected sermons, which appeared the following year, he says: 'I suppose it is needless to inform the public that the reason of printing these sermons arises altogether from the favourable reception which the sermon given as a sample of them in "Tristram Shandy" met with from the world:—that sermon was printed by itself some years ago, but could find neither purchasers nor readers.' Both sermons were republished in the collection.

The first two volumes of 'Tristram Shandy' were originally published at York, towards the end of the year 1759, and were reprinted at London early in 1760. Although anonymous, the work seems to have been known to be Sterne's from the first; and it raised him at once from obscurity to universal notoriety and high literary fame. This and his subsequent publications—two volumes of Sermons in 1760, vols. 3 and 4 of 'Tristram Shandy' in 1761, vols. 5 and 6 in 1762, vols. 7 and 8 in 1765, two more vols. of Sermons in 1766, the 9th vol. of 'Tristram Shandy' in 1767, and the 'Sentimental Journey' in 1768—probably also brought him a good deal of money; and his circumstances were further improved by his being presented by Lord Falconbridge, in 1760, with the curacy of Coxwold (also, we suppose, in Yorkshire), which he calls 'a sweet retirement, in comparison of Sutton.' His celebrity also, it is to be feared, introduced the Yorkshire parson to new habits of life, and to some kinds of dissipation not quite so innocent as 'fiddling and shooting.' In 1760 he took a house at York for his wife and his only child, a daughter: but his own time he seems from this date to have spent mostly either in London or on the Continent. In 1762, before the conclusion of the peace, he went to France, whither he was soon after followed by his wife and daughter. Leaving them both in that country, he seems to have in the first instance returned to England, whence, in 1764, he proceeded to Italy, with a view to the recovery of his health, now greatly impaired. He returned to England in the earlier part of 1767, and, having after some time persuaded his wife to come over to him with their daughter, he remained at York till he had written all that we have of his 'Sentimental Journey,' the first part, which he then brought up with him to the metropolis, and published, as has been already stated, in the beginning of the following year. He lived merely to see the work brought out; having died, at his lodgings in Bond-street, on the 18th of March, 1768 (not the 13th of September, as is stated on his monument erected some years after in the burying-ground of St. George's, Hanover-square, where he was interred). He had saved nothing, if he did not die in debt; but it is said that, soon after, his wife and daughter being at York during the races, a collection which amounted to a thousand pounds was made for them by some gentlemen there; and they also received a liberal subscription for three more volumes of his Sermons, which were afterwards published. In 1775, after her mother's death, Sterne's daughter, who calls herself, at the end of the dedication to Garrick, Lydia Sterne de Medalle (having been married to a person of the latter name), published three small volumes of his Letters to his Friends, along with the short autobiographical memoir from which many of the above facts have been taken. Some of the letters in this collection are of a very extraordinary character to have been either published by a daughter, or left for publication, as we are assured they were, by a wife. The same year there appeared, under the title of 'Letters to Eliza,' ten letters addressed by Sterne, in March and April, 1767, to an East Indian lady, who is described by the editor as a 'Mrs. Elizabeth Draper, wife of Daniel Draper, Esq., counsellor at Bombay, and at present chief of the factory at Surat.' Having come to England for the recovery of her health, she and Sterne became acquainted and were greatly taken with each other. Sterne's letters however certainly do not warrant us in concluding that they were attached by any other feelings than those of a very warm friendship. The lady had been dead some years, as well as Sterne himself,

when his letters to her were published; and the latter part of her life, the editor tells us, had been attended with circumstances which were 'generally said to have reflected no credit either on her prudence or discretion.' But whether there is any real ground for this slander we greatly doubt. Mrs. Draper returned to her husband in India after her correspondence with Sterne, and, then making a second visit to England, died at Bristol, and was interred in the cathedral, where there is a marble monument erected to her memory. With the exception of one or two fragments, the only other remains of Sterne that have been printed consist of a second collection of letters, in one volume, which also appeared in 1775; with the addition of a piece of humourous satire entitled 'The History of a Watchcoat,' which however had been published separately about seven years before.

In 1793 Dr. Ferriar, of Manchester, published an Essay in the third volume of the 'Memoirs of the Manchester Literary and Philosophical Society,' afterwards enlarged and published separately in 1798, and again in 1802, under the title of 'Illustrations of Sterne,' with the view of showing that many passages in his writings were suggested by or imitated from various old and commonly neglected authors, especially Rabelais and Burton's 'Anatomy of Melancholy.' In a literal sense, the charge is sufficiently established; there are some passages in Sterne which may be fairly said to be copied from Burton, Rabelais, and others; and the germs of a good many of his thoughts and expressions may be found in their pages. Of course also the general spirit of his wit and turn of writing must have taken something from the sources with which he is thus proved to have been familiar. But however these detections may affect Sterne's reputation for honesty, the question of the originality of his genius is not touched by them. A writer of original genius, under the pressure of haste or indolence, may, if not a scrupulous man, borrow or steal occasionally, as well as the most common-place writer. Sterne, we know, was the reverse of scrupulous; but he may also have had no very felonious intention in the appropriations that are laid to his charge; it will be admitted that he has for the most part really put a new life into what he has thus resuscitated; and he probably thought that in all such cases he gave more than he took. The nature of his writings, it is to be remembered, precluded him from making any formal acknowledgement of his obligations; he could not finish off a chapter in 'Tristram Shandy' with a list of references such as might be appended to an article in a dictionary. Beyond all controversy, he is, in his conceptions and delineations separately considered, as well as in his general spirit and manner, one of the most original of writers. His humour is quite as much *sui generis* as that of either Rabelais or Cervantes or Swift. Whatever he may have in common with any or all of these, he has much more in which he differs from them, and that is wholly his own. He is, of all English humourists at least, the airiest and most buoyant. And it is wonderful what a truth and real humanity there is even in his most startling and eccentric creations; how perfectly unity of character and every artistic probability is preserved in each of them; how they all draw our sympathies towards them; how they live like actual existences in our memories and our hearts. It is rather a simple fact than an opinion that the first class of Sterne's *dramatis personæ*, his Uncle Tobys, his Corporal Trims, his Yoricks, rank in that department of our literature next to the Launces and Touchstones, the Malvolios and Justice Shallows, of Shakspere, and far apart from all else of the same kind in the language. In the mere art of writing also, his execution, amid much apparent extravagance, is singularly careful and perfect; it will be found that every touch has been well considered, has its proper purpose and meaning, and performs its part in producing the effect; but the art of arts, the *ars celare artem*, never was possessed in a higher degree by any writer than by Sterne. His greatest work, out of all comparison, is undoubtedly his 'Tristram Shandy;' although, among foreigners, the 'Sentimental Journey' seems to stand in the highest estimation. But that will hardly be the judgment of any Englishman,—though it may be of some English women.

STERNHOLD, THOMAS, was a native of Hampshire. The date of his birth is not known. He was educated at Oxford. He was groom of the robes to Henry VIII., and retained the same office under Edward VI., in whose reign he died, August, 1549.

Sternhold's only claim to distinction is, that he was the principal author of the first English metrical version of the Psalms attached to the Book of Common Prayer. He had undertaken to versify the whole of the Psalms, but completed only fifty-one: the rest were translated by John Hopkins and others. Sternhold's version was not published till after his death: 'All such Psalms of David as Thomas Sternholde did in his Lyfe drawe into English Metre,' London, 1549, 8vo. He was also the author of 'Certain Chapters of the Proverbs of Solomon, drawen into Metre,' London, 1549, 8vo. The complete version of the Psalms by Sternhold and Hopkins was not published till 1562, when it was first annexed to the Book of Common Prayer, with the title of 'The whole Booke of Psalmes, collected into English Metre, by T. Sternhold, J. Hopkins, and others, conferred with the Ebrue, with apt Notes to sing withal.' The printing was in black letter, and the music consisted of the melodies only, without base or other part. Many of the best melodies were adaptations from the German and French. [PSALMODY.]

The Reformation introduced metrical versions of the Psalms. The Earl of Surrey, who was beheaded Jan. 19, 1546-7, translated some of the Psalms and Ecclesiastes into verse, which, together with a few poems, were printed by Dr. Percy, but never published, the whole impression having been consumed in the fire which destroyed the printing-office of Mr. Nichols in 1808. Sir Thomas Wyatt also published 'Certayne Psalmes, chosen out of the Psalmes of Dauid, commonly called vij. Penytentiall Psalmes, drawn into Englishe Metre; whereunto is added a Prolog of the Aucthore before euery Psalme, very pleasaunt and profettable to the godly Reader,' London, 1549, 8vo. In the same year was published 'The Psalter of Dauid, newly translated in Englyshe Metre, in such sort that it may more decently and with more delight of the mynd be reade and songe of al men; whereunto is added a Note of four parts, wyth other thynges,' &c., London, 1549.

Campbell, in his 'Specimens of English Poetry' (vol. *i.*, 'Essay on English Poetry') observes, that 'in the reign of Edward VI. the effects of the Reformation became visible in our poetry, by blending religious with poetical enthusiasm, or rather by substituting the one for the other. The national muse became puritanical, and was not improved by the change. Then flourished Sternhold and Hopkins, who, with the best intentions and the worst taste, degraded the spirit of Hebrew Psalmody by flat and homely phraseology; and mistaking vulgarity for simplicity, turned into bathos what they found sublime. Such was the love of versifying holy writ at that period, that the Acts of the Apostles were rhymed and set to music by Christopher Tye.' Tye's book is entitled 'The Actes of the Apostles; translated into Englyshe Metre, and dedicated to the Kynge's moste excellent Majestye, by Cristofer Tye, Doctor in Musyke and one of the Gentylmen of his Grace's most honorable Chappell; wyth Notes to eche Chapter, to synge and also to playe upon the Lute, very necessarye for Studentes after theyr studye to fyle theyr wyttes, and also for all Christians that cannot synge to read the good and godlie storyes of the Liues of Christ hys Apostles,' Lond., 1553, sm. 8vo.

(Watt's *Bibliotheca Britannica*, &c.)

STERNOTHE'RUS. [TESTUDINATA.]

STERNUM. [SKELETON.]

STERNUTORIES, called also Ptarmics, agents which cause sneezing. The most familiar are snuffs of different kinds, many of which cause likewise a flow of the natural secretion from the nose, when they are termed errhines. [ERRHINES.] Sternutories are chiefly employed to occasion a violent succession of the frame, either to restore suspended respiration, as in some cases of fainting, or to dislodge some foreign body from the nasal passages or windpipe, or more rarely to cause the bursting of abscesses in the tonsils. They are also used to avert impending fits of hysteria or epilepsy, or to terminate prolonged hiccup. Their use requires caution in individuals disposed to apoplexy or affected with rupture. They are generally improper for pregnant women and young children. They occasionally excite too violent and continued sneezing, which may be controlled by creasote, breathing diluted carbonic acid, or putting a sinapism round the throat.

STESI'CHORUS, one of the earliest and most celebrated lyric poets of antient Greece. The few and fragmentary accounts which we have of him, are not only in direct contradiction to one another, but are manifestly interwoven with various mythical elements. All accounts however agree that he was a native of Himera in Sicily, and son of Euphe-

mus. (Plat., *Phaedr.*, p. 244; Steph. Byz., *s. v.* Ματαυρός.) Among the various statements of the date of his birth, the most probable is, that it was about B.C. 643. He lived to the age of 83, his death having probably taken place in 560 B.C. In his later years therefore he witnessed the tyranny of Phalaris, against whom he is said to have cautioned his fellow-citizens in an apologue called the 'Horse and the Stag.' (Aristot., *Rhet.*, ii. 20; Conon, *Narrat.*, 42; comp. Horat., *Epist.*, i. 10, 34, &c.) The population of Himera consisted of Zanclæans and Syracusans, but the family of Stesichorus had come to the colony from Metaurus. He is said to have been blind for some time, and according to the story this punishment was inflicted on him for having offended by his poems the shade of Helen. His original name was, according to Suidas (*s. v.* Στησίχορος), Tisias, and he assumed the name of Stesichorus as indicating the art to which he mainly devoted his life, that is, the art of training and directing the solemn choruses at the religious festivals. This art appears to have been hereditary in his family, which may be inferred from the fact, that, according to some writers, he was descended from Hesiod, and that after his death there occur two Himeraeans of the same name, who were likewise distinguished in this art. (Marm. Par., *Ep.* 50 and 73.) But Stesichorus Tisias was the most celebrated of the family. It was he who gave to the choral songs the artistic form which was subsequently brought to perfection by Pindar. Before his time a chorus simply consisted of strophes and antistrophes. Stesichorus added the epode, during the recitation of which the choruses stood still. The movements and arrangement of the chorus-dancers were likewise settled by him in a manner which was afterwards observed by other teachers of the chorus and poets, and lastly he introduced a greater variety of characteristic metres than had been hitherto used in the composition of choruses, and had them accompanied by the cithara. In short Stesichorus was regarded by the antients as the creator of the perfect form of this species of poetry, although his choruses were much more simple than those of later times, and bore greater resemblance to epic poetry. The dialect which he used was that of the Epos, interspersed with Dorisms. The subjects of his poetry were all taken from the mythical and heroic ages of Greece, as Quinctilian (x. i. 62) states, and as is clear from the titles and fragments still extant. Some of these epico-lyrical choruses were very long: thus the 'Oresteia' is said to have consisted of two books, and the series of scenes representing the taking of Troy, on the so-called Iliac Table, was taken from this poem. The greater part of these choruses must have consisted of epic narrative; but owing to the solemn character of choral poetry in general, the tone of the narrative is more exalted than in an ordinary epic poem. Quinctilian says that he represented his heroes with their appropriate dignity, and that he might have rivalled Homer himself if he had kept within bounds, and not indulged in an exuberance of words, and not given the reins too much to his imagination. This censure is perfectly justified by the extant fragments.

Besides his choruses Stesichorus composed paeans and hymns which were of a more purely lyrical character. He is also the first Greek poet who wrote erotic poems containing celebrated love stories. The bucolic poetry of Sicily was likewise indebted to him, as he raised it from a rude and unpolished state to classical perfection.

Stesichorus, whom the antients always mention with high admiration, is as a lyric poet totally different from what we usually understand by this term, for his works did not contain any effusions of his own feelings and thoughts, nor did they even, as it would appear, bear any relation to the time and circumstances in which he lived; the subjects were stories belonging to past ages, and taken either from the early traditions of Greece, or from the legends current among the Sicilian peasantry.

After his death the Himeraeans erected a statue, which represented him as a man weighed down by old age, with a book in his hand. (Cic., *c. Verr.*, ii. 35.) Catana disputed with Himera the honour of possessing the tomb of Stesichorus, and magnificent monuments in honour of him were erected in both places.

The fragments of Stesichorus have been collected by J. A. Suchfort, Göttingen, 1771, 4to., and by Blomfield, in the 'Mus. Crit.,' No. 6. The best collection however is that by Kleine, which was published at Berlin, 1828, 8vo., under the title, 'Stesichori Himerensis Fragmenta collegit, Dissertationem de Vitâ et Poesi Auctoris praemisit, C. Fr. Kleine.' They are also contained in Gaisford's 'Poet. Graec. Minor.'

(Müller, *Hist. of the Lit. of Ant. Gr.*, i., p. 197-203; Bode, *Gesch. der Lyrischen Dichtkunst der Hellenen*, ii., p. 40-85.)

STETHOSCOPE. [AUSCULTATION; LAENNEC.]

STETTIN, one of the three governments of the Prussian province of Pomerania, is situated between 52° and 54° 10′ N. lat. and between 13° and 16° E. long. It is bounded on the north by the government of Stralsund and the Baltic; on the east by Koeslin; on the south by Brandenburg; and on the west by Mecklenburg. The area is about 6000 square miles. The population in 1837 was 464,440. The great majority of the inhabitants are Protestants, there being only about 3000 Roman Catholics and 1500 Jews. The government is divided into 21 circles. [POMERANIA.]

STETTIN, the capital of the whole province of Pomerania, as well as of the government of the same name and of the circle of Randow, is one of the most flourishing commercial towns and one of the strongest fortresses in the Prussian monarchy. It is situated in 53° 26′ N. lat. and 14° 45′ E. long., on an eminence on the left bank of the Oder, which divides into four branches, viz. the Oder, or the main stream, the Parnitz, and the Great and the Little Regelitz. The principal and most strongly fortified part of the town is on the left bank of the Oder, and is connected by two wooden bridges, each about 400 feet in length, with the suburb of Lastadie, which extends along the right bank, and is likewise fortified, being protected by ramparts, by the Parnitz, and some marshes. There is another wooden bridge, 380 feet in length, across the Parnitz, one of 120 feet on the Little Regelitz, and one of 630 feet in length on the Great Regelitz. The suburbs Ober- and Unter-Wieck, and of Alt and Neu Torney, are not included in the fortifications. The two latter consist chiefly of farm-houses, inns, and other establishments. The proper citadel is called Fort Prussia, besides which there are forts William and Leopold. The town has five principal gates and eight posterns. There are several squares. Being the capital of Pomerania, as well as of the government of Stettin, it contains all the principal government-offices. Of the public buildings, the most remarkable are—the palace, formerly the residence of the last dukes of Pomerania, the government-house, the arsenal, the house of the provincial estates, with a considerable library, the great barracks, the three hospitals, and the theatre. There are five churches and a Roman Catholic chapel. The above-mentioned library is one of the most complete in Pomerania, and contains many valuable MSS. relative to the history and constitution of the duchy. Besides the gymnasium, to which an observatory is attached, there are a school for training teachers, a school of industry for boys, and a school of navigation, and many others. The charitable institutions are very numerous and well supported. Stettin is the residence of a Protestant bishop and of the French Protestant consistory. The population is 34,000, including the garrison, which is very numerous. The manufactures are woollens, linen, cotton, leather, hats, stockings, ribands, sail-cloth, soap, and tobacco. Boats and ships are built here, and the ships' anchors for all the ships of the Prussian states are manufactured here. The trade of Stettin is very considerable, it being the chief port for the manufactures and produce of Silesia, and for the importation of all kinds of foreign goods, especially colonial produce, for the supply of Silesia, Berlin, and other places. A railway is at present constructing between Stettin and Berlin. The Sound duty makes the conveyance of goods more expensive, and the ships have not always return cargoes. Thus many goods which would naturally be exported from Stettin are sent to Hamburg, which is not subject to the same disadvantage. Another disadvantage is the difficult navigation of the Oder, ships drawing more than seven feet water being obliged to stop at Swinemunde on the Same, one of the channels by which the Oder empties itself into the Baltic. The channel was however deepened in 1827. The number of ships that arrive here annually is about 1000, of which perhaps a fourth may belong to the merchants of Stettin. There are resident consuls of England, France, Russia, Sweden, the Netherlands, Denmark, Hanover, Portugal, and North America.

Among the remarkable persons born at Stettin, was the most extraordinary woman of her age, Sophia Augusta Frederica, princess of Anhalt-Zerbst, afterwards the empress Catherine II. of Russia, and Sophia Dorothea, princess of Würtemberg, mother of the reigning em-

peror of Russia. The fathers of the two empresses were governors of Stettin. The magistrates having complimented Catherine on her accession to the throne, she ordered that one copy of every gold medal struck in Russia should be given to the city, which has between 90 and 100 of these medals. (Müller, *Handbuch;* Hörschelman; Hassel; Stein.)

STEUART, SIR JAMES, born at Edinburgh, October 21, 1712, was the only son of Sir James Steuart, solicitor-general for Scotland, under Queen Anne and George I. After being admitted at the Scotch bar at the age of 24, he proceeded to the Continent, where he spent several years, and at Rome was introduced to the young Pretender. He was unfortunately called to Edinburgh by the illness of his wife at the period of the rebellion of 1745, where his intercourse with Charles Edward was resumed, though he took no part in promoting his designs. After the battle of Culloden he found it prudent to retire to the Continent, where he remained for the next seventeen years. In 1763 he was permitted to return to his native country on the understanding that he would not be molested so long as he remained quiet, but it was not until 1771 that he received a free pardon. Having settled at Coltness, the seat of his family, in the county of Lanark, he finished the most important of his works, on which he had been engaged during his long exile. It was purchased by Andrew Miller, the bookseller, for 500*l*., and appeared in London in 1767, in two quarto volumes, entitled 'An Inquiry into the Principles of Political Economy.' As the British law of copyright did not extend to Ireland, an edition in three volumes octavo was published in Dublin in 1770, which is said to have been circulated rather extensively in the British colonies; and in 1770 a second edition of the work was called for in England. He wrote also on the coinage of Bengal; on a plan of uniform weights and measures; and while on the Continent published in French a 'Vindication of Sir Isaac Newton's Chronology;' and he was also the author of several metaphysical disquisitions, the two principal ones being on Beattie's 'Essay on Truth,' and Mirabaud's 'System of Nature.' He died in November, 1780, aged 67. His only son, General Sir James Steuart, erected a monument to his memory in Westminster Abbey, and in 1805 he published a complete edition of his father's works, in six volumes octavo.

It is remarkable that Adam Smith, whose work on the same subject appeared nine years after Steuart's, has not once referred to his predecessor. He is stated to have said that he understood Sir James's system better from his conversation than his volumes (*Life of Sir J. Steuart*); and Mr. M'Culloch remarks, that his statements and reasonings are 'singularly perplexing, tedious, and inconclusive,' though he adds that his work 'is by no means destitute of enlarged and ingenious views.' The first book treats of population and agriculture; the second, of trade and industry; the third, of money and coin; the fourth, of credit and debts, and incidentally of interest and banks; and the fifth book relates to taxes. At the end of each book there is a useful resumé of the argument. The first book has the merit of placing the theory of population in nearly the same light as that in which it is now generally viewed. The author's want of confidence in the efficacy of the commercial principle is in striking contrast with the views of Adam Smith. He proposed that granaries should be established for the purpose of collecting stores of corn in cheap years and selling them in dear years. But the work is now entirely superseded, and is interesting chiefly in connection with the history of political economy.

STEVENAGE. [HERTFORDSHIRE.]

STEVENS, GEORGE ALEXANDER, was born in London, and brought up to a trade, which he deserted at an early age for the profession of a strolling player, in which he continued several years, chiefly in the Lincoln company. In 1751 he had an attack of illness, and published a poem entitled 'Religion, or the Libertine Repentant.' In 1752 the Libertine had ceased to be repentant, and obtained an engagement at one of the Dublin theatres, where he produced a burlesque tragedy, called 'Distress upon Distress.' In 1753 he was engaged for Covent Garden Theatre, and came to London. Stevens was not a good actor, but he wrote songs which he sang at convivial societies, where he and his songs were much admired. He led a life of dissipation, was generally necessitous, and always extravagant. In 1760 he published a novel, 'The History of Tom Fool,' 2 vols. 12mo.

The first sketch of the work by which Stevens is chiefly known, the 'Lecture on Heads,' was intended for Shuter the actor, to be used at his benefit; but he did not avail himself of it. Stevens then enlarged the plan and improved the details, and having furnished himself with the necessary apparatus of heads, &c., in 1763, or thereabouts, he began to perform it in the principal towns of England and Scotland, with great success and a large profit. He afterwards went to North America, where he was not less successful than he had been in England. After a stay of about two years he returned, and then proceeded to Ireland. In a few years he realised about 10,000*l*. In 1766 he produced a 'Supplement; being a New Lecture upon Heads.' It was only performed six nights. In 1770 he brought out a burletta, 'The Court of Alexander,' which was set to music by Dr. Fisher, but added nothing to the fame of either author or composer. In 1772 he published his 'Songs, Comic and Satirical,' Oxford, 12mo. In 1773 he exhibited 'A Trip to Portsmouth.' After giving his 'Lecture' a few times more, he sold it to Lee Lewis, who, with the assistance of Mr. Pilon, made some improvements, and continued to perform it with tolerable success for some years. Meanwhile Stevens's faculties began to fail, and he sank into a state of fatuity, in which he continued several years, till his death, which took place September 6, 1784, at Biggleswade, in Bedfordshire. (The 'Biographie Universelle' says at Baldock in Hertfordshire, we believe erroneously.) After Stevens's death was published, in 1788, 'The Adventures of a Speculist; compiled from the Papers of G. A. Stevens: with his Life, a Preface, and Notes, by the Editor.'

Stevens's 'Lecture on Heads' has a thin sprinkling of wit, many bad puns, much caricature, and a good deal of satire more extravagant than forcible; but the absurdities of dress, manners, modes of speaking, and other peculiarities of the day, were exhibited with so much liveliness, if not truth, as to render the performance exceedingly attractive. One of the best bits is perhaps the report of the trial, 'Bullum *versus* Boatum.' 'Daniel *versus* Dishclout' is not so good. Stevens's 'Songs, Comic and Satirical,' amount to more than a hundred. They were considered classical by the Choice Spirits of that time, being filled with heathen deities, Venus, Cupid, Mars, Bacchus, and so forth, together with personifications of the virtues and vices. They are chiefly bacchanalian and amatory, several are satirical, a few licentious, but not one 'comic.' Only one has retained its popularity, 'The Storm,' which is indeed the only one which deserves to be popular. It appears in Stevens's Songs as 'The Marine Medley.' It has been since altered; some of the worst lines have been omitted, and others more suitable substituted, the versification of the stanzas made uniform, and indeed the song as a whole is improved. Still there are bad lines, as, for instance, the first, 'Cease, rude Boreas, blustering railer,' but this line is not in the original song. With all its defects however there is so much animation and truth of description, and the scene with all its circumstances is exhibited by the supposed narrator with such natural earnestness and energy, as to render the song, in its kind, perhaps one of the best in the language.

(*Life*, attached to Stevens's *Works;* Baker's *Biographia Dramatica;* Watt's *Bibliotheca Britannica; Biographie Universelle.*)

STEVENS, RICHARD JAMES SAMUEL, a composer of numerous glees, many of which display the most brilliant traits of genius, was born in London, about the year 1753, and educated in St. Paul's cathedral, under Richard Savage, almoner and master of the choristers. His first appointment was as organist to the Temple church. In 1795 he succeeded Mr. Jones in the office of organist of the Charter-house; and in 1801, on the death of Dr. Aylward, was elected professor of music to Gresham college. In 1782 he gained the prize-medal from the Catch Club for a serious glee, and another in 1786 for a cheerful glee. These, with many more compositions of the same class, particularly his five-voiced glee, from Ossian, 'Some of my heroes are low,' in which the poetry and science of music are equally blended, speedily and most deservedly obtained the stamp of public approbation, which they will never lose so long as vocal harmony shall be admired.

Mr. Stevens published three sets of glees and some songs, and edited a useful collection of anthems, &c, in three folio volumes. He died in 1837, leaving one son.

STEVIN, SIMON, a celebrated Flemish mathematician, was born about the middle of the sixteenth century, at Bruges: it has been ascertained that he went to reside in Holland, where he obtained the title of mathematician to Prince Maurice of Nassau, and that he was made civil-engineer to the States, the charge of constructing and repairing the dykes being confided to him. It is to be regretted that no other particulars concerning his life have been preserved: even the year of his death is unknown.

He wrote a treatise on arithmetic, which was printed at Antwerp in 1585; and in the same year he published a collection of geometrical problems in five books. He appears to have studied algebra with great attention, and to have made in that branch of science several improvements. The principal of these consist in the employment of fractional indices, as exponents of the roots of quantities (the use of integers as the exponent of powers had previously been introduced by Stifel), and in a general but laborious method of approximating in numbers to the root of any equation. He represented the unknown quantity by a small circle; and a number, either integral or fractional, contained within the circle, indicated a power or root of that quantity.

In 1586 Stevin published in quarto, and in the Dutch language, his tract on statics and hydrostatics, in the preface of which he endeavours to prove that the Dutch language is more antient than any other; and in the same year he published, also in Dutch, his 'New System of Fortification.' In 1589 he brought out a tract entitled 'De Motu Cœli;' and ten years afterwards, in Dutch, a treatise on navigation: the latter was translated into Latin by Grotius, and published at Leyden in 1624.

In 1605 W. Snell translated into Latin, and published in two volumes, folio, the greater part of the works of Stevin, but he did not live to complete the undertaking. In 1634 however Albert Girard published, at Leyden, the whole of the works in French: this edition contains the treatise on arithmetic; the six books of the algebra of Diophantus (the four first books were translated from the Greek by Stevin, and the others by Girard), and an explanation of the tenth book of Euclid; tracts on cosmography, geography, and astronomy, the practice of geometry, statics, optics, castiametation, a new system of fortification, and a method of fortifying places in which manœuvres of water, by means of sluices, were to contribute to the defence.

The work on statics contains a simplification of the demonstration of Archimedes relating to the fundamental property of the lever. Stevin represented the two weights at the extremities of the lever by parallelopipeds suspended horizontally by strings applied at their middle points: the breadths and depths of these parallelopipeds were equal, but the length of each was double the distance from the fulcrum of the lever to the point from which the other was suspended. When the parallelopipeds were placed end to end, the middle of the whole was vertically under the fulcrum of the lever, and therefore the latter was necessarily in equilibrio, while the weights of the separate parallelopipeds were inversely proportional to the lengths of the arms from whose extremities they were suspended.

In order to exhibit the conditions under which a body is in equilibrio on an inclined plane, Stevinus supposes a triangular prism to be placed with one side parallel to the horizon, so that the other sides may form a double inclined plane; and he imagines a string, on which are placed a number of equal weights, at equal distances from one another, to be laid on those sides across the upper edge of the prism: each part of the string of weights extends from the edge to the base of the prism; or the two extremities of the string are at equal distances below that base. He concludes that the string so placed would be at rest on the two planes, because if it were to begin to move (the string of weights being of infinite length), it would move for ever, which he supposed to be absurd, so that the tendency of the weights to descend on one side must exactly counterbalance the like tendency of those on the other side; and evidently the sum of the weights lying on one plane is to the sum of the weights lying on the other, in the same proportion as the lengths of those planes respectively, the lengths being measured in directions perpendicular to the edge of the prism. Hence he infers that the same power is required to support different bodies on single inclined planes of equal heights, when the weights of the bodies are proportional to the lengths of the planes. If one side of the prism is in a vertical position, the tendency to descend is evidently equal to the weight; and hence, on every inclined plane, the sustaining power, in a direction parallel to the plane, is to the weight of a body, as the height of the plane is to its length.

From this theory, also, Stevin discovered that an equilibrium between three forces acting at one point in a body, takes place when the forces are parallel and proportional to the three sides of a triangle. His demonstration however extends only to the case in which the directions of two of the forces are at right angles to one another; for he states that when a body is supported on an inclined plane, and retained by a force acting parallel to the plane, it is in the same circumstances as if it were suspended by two strings, one perpendicular, and the other parallel to the plane; and he concludes that the ratio of the weight of the body, to a force parallel to the plane, is as the hypotenuse to the base of a right-angled triangle formed by three lines, one in a vertical direction, another perpendicular to the plane, and the base or third side being in a horizontal position.

Stevin is said to have contrived a car which moved by means of sails, on the flats of Holland, with more rapidity than any carriage drawn by horses.

STEWARD, LORD HIGH, OF ENGLAND, one of the antient great officers of state. Under the Norman kings and the early kings of the Plantagenet line it seems to have been an hereditary office. Hugh Grentmesnell held the office in the reign of Henry II., and it passed with his daughter and co-heir in marriage to Robert de Bellomont, who was earl of Leicester. Robert's son held it, on whose death without issue it passed to the husband of his sister, the elder Simon de Montfort, who had also the dignity of earl of Leicester. From him it passed to his son, the second Simon de Montfort, who was slain at the battle of Evesham in 1265. This high dignity then reverted to the crown, but was immediately granted to Edmund, king Henry the Third's younger son, together with Montfort's earldom of Leicester, in whose descendants, the earls of Lancaster and Leicester, it continued, and in the person of Henry the Fourth, who was duke of Lancaster, was absorbed into the regal dignity.

From this time no person has been invested with this high dignity as an heritable possession, or even for his own life, or *quamdiu se bene gesserit;* but only for some special occasion, the office to cease when the business which required it was ended; and this occasion has usually been when a person was to be tried before the House of Peers. On this occasion there is a lord high steward created, who presides, and when the proceedings are closed, breaks his wand, and dissolves the court; but if the trial take place during the session of parliament, though a lord steward is appointed, it is not considered as his court, he having none of the functions of the judge, only voting with the rest as a peer, although he presides.

STEWART, MATTHEW, D.D., a mathematician of North Britain, who attained great distinction by his researches in the higher branches of science, and the success with which he cultivated the antient geometry. He was born at Rothsay, in the Isle of Bute, in 1717; and having received the best education which a grammar-school afforded, he prosecuted his studies in philosophy and theology at the University of Glasgow, into which he was admitted in 1734. Dr. Simson, who then occupied the chair of mathematics in that university, is said to have early discerned the predilection of Stewart for mathematical researches; and his lectures appear to have given his pupil that decided preference for the antient over the modern analysis, which he retained to his death.

On going to reside in Edinburgh, Mr. Stewart attended the lectures of Maclaurin, till, having adopted the church as a profession, he was appointed to the living of Roseneath, in the west of Scotland. In 1747 however, on the death of that mathematician, he was elected to succeed him; and he held the post of mathematical professor in the University till 1772, when his health began to decline. His son, the late Dr. Dugald Stewart, from that time began to assist him by occasionally delivering lectures; and three years afterwards the young mathematician and philosopher was appointed joint professor with his father. In 1775 he retired to an estate in Ayrshire, where he spent nearly all the rest of his life in cultivating science as an amusement. He was elected a Fellow of the Royal Society in 1764; and he died in 1785, being then sixty-eight years of age.

The first efforts of Dr. Stewart in science were to extend the subject of what is called the 'locus ad quatuor rectas' to the powers of any number of perpendiculars drawn to an equal number of lines. While engaged in this pursuit, after his retirement to Roseneath, he discovered most of those propositions which, in 1746, he published under the title of 'Geometrical Theorems.' These, which are mostly porisms, are sixty-nine in number, but five only of them are accompanied by demonstrations. Dr. Stewart is said to have suppressed, for the sake of brevity, the proofs of the others; but several of the theorems were afterwards demonstrated by Dr. Small, and Mr. Lowry has given, in Leybourne's 'Mathematical Repository,' demonstrations of all those which admit of investigation by the processes of the antient geometry.

In the first volume of the 'Essays of the Philosophical Society of Edinburgh,' there is a paper by Stewart containing some propositions founded on a theorem in the fourth book of Pappus; and, in the second volume of the same work, he gave a solution of 'Kepler's problem,' in accordance with the methods of the antients. This he accomplished by the application of a property of curves, from which the approximations may be carried to any degree of accuracy in a series of rapidly converging results.

In 1761 he published his 'Four Tracts, Physical and Mathematical,' in which there is an attempt to investigate the higher parts of mixed mathematics in a manner conformable to the spirit of the Greek geometry. The first tract contains the theory of centripetal forces in a series of propositions, which, admitting the quadrature of curves, are rigorous; and in the remainder of the work Dr. Stewart considers the intricate subject of the perturbations. His design was to carry on the approximations for determining the elements of the orbits according to the method in which Newton, Machin, Walmsley, and other eminent mathematicians had begun the investigations; but the work stops far short of the ends now proposed in the researches of physical astronomy.

In the following year he published a series of geometrical propositions, which are investigated analytically, and afterwards demonstrated by synthetical processes: they are entitled, 'Propositiones More Veterum demonstratæ,' and this designation is said to have been given to them by Dr. Simson. His last work was an 'Essay on the Sun's Distance;' and this problem he endeavoured to treat according to the method of the antients, but the subject is too intricate to admit of their analysis being applied to it, though the work exhibits all the ingenuity which might be expected from the learned author. Making use of the movement of the moon's apsides as an effect of solar perturbation, he determined the parallax of the sun to be 6·9″, and it is now known to be about 8″. Being obliged, in order to diminish the complexity of the investigation, to reject quantities which were supposed to have but small influence on the result, considerable errors exist in the steps; and, except that compensations occurred, the parallax might have appeared to be three times as great as it is in reality. The 'Essay' was much animadverted on by Dawson and Landen during the life of the writer; and since the true parallax of the sun has been ascertained from the transit of Venus, in 1769, it is admitted that no reliance can be placed on the determination of such an element by inductions drawn from the effects of the mutual attractions exercised by the bodies of the solar system.

STEWART, DUGALD, the son of Dr. Matthew Stewart, was born in Edinburgh, on the 22nd of November, 1753. He was educated at the high school of Edinburgh, and the progress he made in classical and mathematical attainments was such as to excite the warmest expectations of future success. In the winter of 1772, having that year attended the course of lectures delivered by Dr. Reid at Glasgow, his love for metaphysical speculation was roused, and he wrote and read to a literary association an 'Essay on Dreaming,' which he afterwards incorporated in his 'Elements of the Philosophy of the Human Mind' (vol. i., chap. v., § 5). He was then in his nineteenth year. But still more decisive was the fulfilment of his early promise a short time afterwards, when, having completed his Glasgow studies, he assumed the charge of the mathematical classes hitherto taught by his father in the university of Edinburgh (Chalmers's *Biog. Dict.*), and on coming of age he was appointed mathematical professor.

He taught with great success until his five and twentieth year, when an occasion presented itself for his resuming his favourite studies under the most advantageous position. Dr. Ferguson, the then professor of moral philosophy at Edinburgh, having been sent as secretary to the commissioners to conclude peace with North America, Dugald Stewart was called upon to fill his place during his absence, which he accepted, and during the session 1778-9, besides teaching his own classes of mathematics, and one on astronomy, he lectured on ethics for Dr. Ferguson; thinking over every morning the subject of lecture for the day, and addressing his pupils extempore. His amiable and elegant manner was much relished, and his lectures gave so much satisfaction, that on the retirement of Dr. Ferguson, in 1785, he was appointed his successor. He had previously had the care of a few private pupils of rank whom he received into his family. He was thirty-two years of age when he entered upon his new professorship. His mind had become enlarged and enriched with a discursive, desultory, but valuable erudition, his opinions had become fixed, and the habitual grace and mildness of his manner had become still more winning from his increasing confidence and facility of exposition. He became very popular. His lecture-room was crowded, his fame spread over Great Britain before he had published anything, and, as Sir James Mackintosh truly remarks, 'without derogation from his writings it may be said that his disciples were among his best works.' His first work therefore came heralded by fame, and it scarcely disappointed. It was the first volume of his 'Elements of the Philosophy of the Human Mind,' which appeared in 1792. The subject was treated with an elegance and eloquence of diction and a richness of illustration which more than compensated the majority of readers for its deficiencies in profundity and logical sequence of ideas; indeed its very faults were helps to its popularity, because it satisfied the current tendency to reaction against the sensualist school, and at the same time made no great demand on the speculative faculty of its reader. The philsophy was that of Reid, but rendered attractive by those arts of composition to which Dugald Stewart paid such fastidious attention; yet of this philosophy, and of Dugald Stewart's works generally, we may say with Professor Cousin, 'it was an honourable protestation of common sense against the extravagancies and extreme consequences of sensualism. But it proceeded no further in its path than did Locke in his. The Scotch philosophy limited itself to the re-establishment of some of the forgotten elements of human nature, and some of the fundamental ideas of reason, which it described such as they now incontestibly appear; but it did not attempt to account for them, nor to ascend to their origin, nor to follow them in their legitimate applications; it had a commencement of psychology, but no regular logic; it had neither a metaphysic, nor a theodicea, nor a cosmology; it had a little of morals and politics, but no system. The merits of the Scotch, as of Locke, are clearness and good sense; their faults are the absence of any speculative ability, the want of comprehensiveness and of rigorous precision.' (*Cours de Philosophie, Intro. à l'Hist. de Phil., Leçon XII.*)

In the following year (1793) Dugald Stewart published his 'Outlines of Moral Philosophy,' a text-book for his pupils; and the 'Life of Adam Smith,' which appeared in the 'Transactions' of the Royal Society of Edinburgh; and which was followed by the 'Life of Dr. Robertson' in 1796, and the 'Life of Dr. Reid' in 1802. They have been subsequently reprinted. His activity was unceasing; and in 1800 he added a series of 'Lectures on Political Economy' to his heavy professional duties, but they were not continued. On several occasions when his colleagues were ill, he gave temporary lectures for them on natural philosophy, logic, and rhetoric. In the winter of 1808-9, from grief at the loss of his younger son, which brought on a severe indisposition, he was obliged to have a deputy to discharge his duties. In the following session, seeing little prospect of recovering his health, he resigned altogether; and in May, 1810, Dr. Thomas Brown, his late assistant, was appointed in his place. Dugald Stewart, having now retired from public life, lived constantly at Kinneill House, on the Frith of Forth, about twenty miles west from Edinburgh, where he devoted himself to the prosecution of his favourite studies. The fruits of his retirement were not slow in manifesting themselves: in 1810 appeared his first volume of 'Philosophical Essays,' in the preface to which he says, 'The state of my health having interrupted, for many months past, the continuation of my work on the human

mind, I was induced to attempt, in the mean time, the easier task of preparing for the press a volume of Essays.'. Yet it is in this work, which he considered the 'easier task,' that he has best proved his claim to the title of a metaphysician, which is noticed both by Sir James Mackintosh and Professor Cousin (*Fragmens Philosophiques*, p. 78); indeed his chief work, as he frankly owns, is rather a collection of such theories pointing towards the common end of throwing light on the structure and functions of the mind, than a systematic treatise, such as might be expected from the title of elements. 'It is in essays of this kind,' says Mackintosh, 'that he has most surpassed other cultivators of mental philosophy. His remarks on the effect of casual associations may be quoted as a specimen of the most original and just thoughts, conveyed in the best manner.' (*Dissertation prefixed to Ency. Britan.*, p. 329.) The 'Philosophical Essays' reached three editions in seven years: the contents of the volume are various and interesting,—on Locke, Berkeley, Influence of Locke on the Philosophy of France; Metaphysical Theories of Hartley, Priestley, and Darwin; on Philological Speculations; on the Beautiful, Sublime, Taste, and Culture of Intellectual Habits. In 1814 the second volume of his 'Elements of the Philosophy of the Human Mind' appeared; but was not so well received, and never, we believe, reached a second edition. In 1815 appeared his celebrated Preliminary Dissertation to the Supplement of the 'Encyclopædia Britannica,' entitled 'A General View of the Progress of Metaphysical, Ethical, and Political Science since the Revival of Letters;' a work for which his discursive reading well fitted him. It enjoys considerable popularity, and chiefly owing to these very qualities, for as a philosophical view of the progress of the metaphysical sciences it is almost worthless. He never once rises to any comprehensive principle. There is no unity in that mass of writing, of criticism, and notes. He never attempts to seize the spirit of each age, and to show how it influenced others. All is isolated. Pleasant and clever as the *adversaria* of some student, but very inefficient if looked on as a treatise or consulted as a history. As a specimen of his carelessness, we may mention the entire omission of Spinoza, a man whose influence on speculative philosophy has been only second to that of his master Des Cartes. His extreme carelessness as to any systematic comprehension of what he was to perform, and his neglect as to arrangement of materials, are, as is remarked by a writer in the 'Quarterly Review,' shown in the author's 'advertisement,' wherein we are told that his original design (as is well known to his friends) was to comprise in ten or twelve sheets all the preliminary matter which he was to contribute to the 'Supplement.' It has now extended to six times this length, and we are informed that he has only discussed one of the three divisions under which he had projected to arrange his subject. We cannot but observe that this fact sufficiently justifies all that we had ventured to say on the desultory and unpremeditated manner in which the work must have been prepared. Yet in the face of this, and of the internal evidence of its desultory nature, Sir James Mackintosh declares this discourse to be 'the most splendid of Mr. Stewart's works.' (*Edin. Review*, Sept., 1816, p. 191. See also a second article by the same hand on this Discourse, *Edin. Rev.*, Oct., 1821, pp. 220-267.)

He remained silent from this period till 1821, when the second part of his 'Discourse' was published, and attracted as much attention as the former, and more hostility, because it was principally occupied with a weak and cavilling attack on Locke and his school. The following year he suffered from palsy, which interrupted his labours till 1827, when he published the third volume of his 'Elements.' In 1828, a few weeks before his death, he published his 'View of the Active and Moral Powers,' by far the least exceptionable of his works. It is more systematic, and contains more new truths than any of his metaphysical writings, and his long acquaintance with the world and with letters enabled him to suggest many obvious but overlooked analyses. It is not a profound, but it is an agreeable book.

Dugald Stewart died on the 11th of June, 1828, in the 75th year of his age, and was buried in the Cannongate churchyard, Edinburgh.

We have also to add to the list of his philosophical writings, an interesting 'Account of a Boy born blind and deaf,' to which no date is affixed.

The admirers of Dugald Stewart style him the Plato of the Scotch School, to which title he has undoubtedly as much claim as Reid has to that of Socrates. But without having himself discovered any important elements which others had overlooked, without even reducing to a system the discoveries of his predecessors, it cannot be denied that his influence was a beneficial one, for he not only strengthened the weaker parts of the ethical doctrines of Ferguson and Reid (Victor Cousin, *Fragmens Philosophiques*, p. 78), and rendered the metaphysical doctrines of Reid less objectionable and confused, by substituting the 'laws of human thought or belief' for the absurd 'common sense' or 'instinct' which were by Reid assumed as final arbiters, but he also adorned the school by every charm of mild enthusiasm and elegance of diction, and rendered the study attractive, by enlisting in its cause the aid of much elegant literature and an exquisite taste, at least such as was in those days regarded as exquisite, when an exclusive regard to diction was the exercise of the most refined taste. 'Few writers,' remarks his friendly critic, 'rise with more grace from a plain groundwork to the passages which require greater animation or embellishment. He gives to narrative, according to the precept of Bacon, the colour of the time, by a selection of happy expressions from original writers. Among the secret arts by which he diffuses elegance over his diction, may be remarked the skill which, by deepening or brightening a shade in a secondary term, by opening partial or preparatory glimpses of a thought to be afterwards unfolded, unobservedly heightens the import of a word, and gives it a new meaning without offence against old use.' (*Edin. Rev.*, 1816.) Sir James Mackintosh afterwards repeated this verbatim in his 'Preliminary Dissertation,' p. 321; so that it may be regarded as his deliberate judgment. A want of depth, indeed of speculative power, is everywhere manifested in Stewart's writings, and the most glaring contradictions to his own principles impeach his logical rigour; but the style and his calm earnestness always render his works interesting to students.

(*Ency. Brit.*, art. 'Stewart;' Sir J. Mackintosh's *Preliminary Diss. to Ency. Brit.*)

STEWARTON, a town in Ayrshire, 18 miles south-south-west from Glasgow, on the road to Kilmarnock, from which it is distant five miles. The parish is in the district of Cunningham: and extends ten miles in length from north-east to south-west, and from three to four in breadth. The area is about 10,145 acres. There are no lofty hills; but the land slopes from north-east to south-west, in which direction the Annock-water, which drains the parish, flows. Freestone and limestone are dug, but there is no coal. The population in 1831 was 4503, viz. 2234 in the town, 735 in the suburbs, and 1534 in the rural district; a later calculation (1836) makes the population 4562. The town of Stewarton is on the north bank of the Annock-water: it has risen to importance only since the extension of manufactures of late years: it has however long had a manufacture of Highland bonnets, of which it is now the chief seat, and in connection with which are mills for carding and spinning wool. The manufacture of carpets has also been introduced, as well as the weaving of silks, muslins, linens, and damasks. The market is on Thursday, and there are six yearly fairs. The church is in the centre of the town: it has sittings for 1400 persons. There are meeting-houses for the dissenters of the United Secession Church and for Burghers. A small Independent congregation meets in the town-house. The parish is in the synod of Irvine and presbytery of Glasgow and Ayr. There were in 1834 ten schools in the parish, viz. the parish school, with an average attendance of about 27, viz. about 14 boys and 13 girls, and nine others: the whole number of children under 15 years, who had learned or were learning to read, was 316; to write, 275.

(Chambers's *Gazetteer of Scotland*; *Parliamentary Papers*.)

STEYER, the capital of the circle of the Traun, in Upper Austria, is situated at the conflux of the Steyer and the Enns, in a beautiful valley, surrounded with hills and lofty mountains. It is situated in 48° 4′ 15″ N. lat. and 14° 20′ E. long., 92 miles south of Vienna, and 16 miles south-south-east of Linz.

Steyer has nine suburbs and five gates. The town is on the left bank of the Enns, which separates it from the suburb Ennsdorf, as the Steyer does from Steyerdorf, with which two suburbs it is connected by two bridges. From the latter suburb, almost at the confluence of the two rivers, there is a most delightful prospect. On a steep rock, on the right bank of the Steyer, the castle of Prince Lamberg stands on

the site of the old castle, which was built between 980 and 990, and was for many centuries the residence of the princes of Styria, till they removed to Grätz. Steyer is a neat and a pretty large town, with above 10,000 inhabitants. Many of the streets are narrow and crooked. There are three squares: the principal square is very large and ornamented with two fountains. Many of the houses are built in the Italian style, with flat roofs, galleries, and statues, especially in the great square. Among the public buildings the most worthy of note are the church of the Dominicans (in the great square), with antient painted glass windows; the antient parish church, a massy Gothic edifice, with a lofty tower, from which there is a fine prospect over the town and the country, to the distant summits of the Alps; the old and the new town-house, St. Michael's church, formerly belonging to the Jesuits; the theatre, the barracks, and four hospitals. Steyer is the seat of the court of justice of the circle of the Traun, and of a superior mining-court. There are a normal and four other schools. Steyer has some woollen and cotton manufactures, but it is chiefly remarkable for those of iron, which employ above 12,000 workmen in the town and neighbouring country. The principal establishment is a manufactory of fire-arms on account of government; of the numerous other articles the chief are sword blades, daggers, bayonets, files, razors, awls, to which some writers add scythes, and kitchen utensils of all kinds; but Mr. Jenny (who, in his description of the town, includes them in his list) gives a note at the end of his work, in which he says that no such articles are manufactured here. Steyer is one of the most important and flourishing manufacturing towns in Austria, and has a very extensive trade, especially to Turkey and the Levant. In the sixteenth century Steyer was the richest town in Austria next to Vienna. It has several times suffered severely by fire.

(Blumenbach, *Oesterreichische Monarchie*; Jenny, *Handbuch für Reisende in dem Oesterreichischen Kaiserstaate*; *Oesterreichische National Encyclopädie*; Cannabich; Stein; &c.)

STEYERMARK. [Styria.]

STEYNING. [Sussex.]

STICKLEBACK, the common name in this country for certain small fishes which constitute the genus *Gasterosteus* of Linnæus. This genus is arranged by Cuvier with the mail-cheeked Acanthropterygians (*Loricati*), and is distinguished by the following characters:—Anterior dorsal represented only by free spines; body generally scaleless, but protected more or less at the sides by shield-like plates; ventrals reduced to a single spine; head without spines or tubercles; branchiostegous membrane with three rays.

Several species of stickleback are found in the ponds and streams of this country, and one species is found in the salt water; they are very active and voracious, and live upon aquatic insects and worms.

The most common species is the three-spined stickleback (*Gasterosteus aculeatus*, Linn.), which is distinguished by the body being protected at the sides with shield-like plates, and the possession of three spines on the back. It is of an olive colour above and silvery white beneath, and varies from two to three inches in length. In the breeding season the males assume a pink hue on the under parts of the body, and the general colouring of the upper parts is brighter, and often green. According to Bloch, this species spawns in April and June; and according to Cuvier, in July and August.

The number of scaly plates varies in the sides of the body, and is supposed by some authors of high authority to afford specific characters. The following are the principal varieties or species established by Cuvier and Yarrell chiefly upon this character.

G. trachurus, rough-tailed stickleback (Yarrell, *Brit. Fishes*, vol. i., p. 76). The scaly plates extending the whole length of the sides; in number about thirty.

G. semiarmatus, half-armed stickleback, Yarrell. Lateral plates extending to a vertical line joining the vent and commencement of the soft dorsal; in number from twelve to fifteen.

G. leiurus, smooth-tailed stickleback, Yarrell. Lateral plates extending only as far as the ends of the rays of the pectoral fins, where these last are laid back.

G. brachycentrus, short-spined stickleback, Yarrell. Lateral plates not extending beyond the pectorals; dorsal and ventral spines very short.

The above are regarded as varieties of the *Gasterosteus aculeatus*, Linn., by Mr. Jenyns, who observes that that species 'is subject to great variation, not only in the number of lateral plates, but in several other less obvious respects. The former may occasionally be found of every intermediate number between that which characterises the *G. leiurus*, Cuv., and that which appears in the *G. trachurus* of the same author. This number moreover is sometimes found constant in specimens which differ remarkably in other respects; at other times varying, when all other characters remain the same. From these circumstances combined, I feel satisfied that the above are mere varieties, notwithstanding the high authorities on which they stand recorded as distinct species.' (*Manual of British Vertebrate Animals*, p. 349.)

A writer in the 'Magazine of Natural History,' vol. iii., p. 329, relates some interesting observations illustrative of the habits of these little fishes whilst in confinement in a tub. 'When a few are first turned in, they swim about in a shoal, apparently exploring their new habitation. Suddenly one will take possession of a particular corner of the tub, or, as it will sometimes happen, of the bottom, and will instantly commence an attack upon his companions; and if any one of them ventures to oppose his sway, a regular and most furious battle ensues: the two combatants swim round and round each other with the greatest rapidity, biting and endeavouring to pierce each other with their spines, which on these occasions are projected. I have witnessed a battle of this sort which lasted several minutes before either would give way; and when one does submit, imagination can hardly conceive the vindictive fury of the conqueror, who, in the most persevering and unrelenting way, chases his rival from one part of the tub to another, until fairly exhausted with fatigue. They also use their spines with such fatal effect, that, incredible as it may appear, I have seen one during a battle absolutely rip his opponent quite open, so that he sank to the bottom and died. I have occasionally known three or four parts of the tub taken possession of by as many other little tyrants, who guard their territories with the strictest vigilance; and the slightest invasion invariably brings on a battle. These are the habits of the male fish alone; the females are quite pacific; appear fat, as if full of roe; never assume the brilliant colours of the male, by whom, as far as I have observed, they are unmolested.'

Dr. James Stark discovered near Edinburgh a new species of the present genus, which greatly resembles the common species, but is rather smaller, and has four spines on the back. It is the *G. spinulosus* (four-spined stickleback) of Yarrell and Jenyns.

A still smaller species—the ten-spined stickleback (*G. pungitius*, Linn.)—is distinguished, as its English name implies, by the possession of ten spines on the back, and these are short and of equal length.

This, as well as the other species of the genus, is occasionally found in the salt-water. It appears to be pretty generally distributed throughout England.

Lastly may be noticed the fifteen-spined stickleback (*G. spinachia*, Linn.), which is also found in England, a comparatively large species, being five or six inches in length, of an elongated and slender form, and having the snout much produced. The fifteen spines on the back are small and short; the fins are proportionally large.

This species appears to be confined to the salt-water, and feeds upon small crustacea, as well as the eggs and fry of other fishes. It constitutes the subgenus *Spinachia*, and is the *Spinachia vulgaris* of Fleming.

STIFEL, or STIFE'LIUS, MICHAEL, a celebrated German algebraist of the sixteenth century, was born at Eslingen, in Saxony; the year of his birth is not known with certainty, but, according to Vossius, it was in 1509. He was a Lutheran clergyman, and a contemporary of Cardan; and it may be mentioned as a remarkable circumstance, that algebra should at the same time have been diligently studied both in the north and south of Europe, apparently without any intercourse being maintained among the persons who were engaged in the pursuit. Of the men who distinguished themselves in the north may be mentioned Rudolph, Stifel, Scheubel, and Stevin; and among those of the south were Ferreus, Cardan, Tartaglia, and Ferrari. The notation employed in Germany differed in some respects from that which was used in Italy; and from this circumstance it has been imagined that the ma-

thematicians of the two countries obtained the first principles of the science from distinct sources.

Stifel's first publication was a treatise on algebra, in German; but in 1544, that is, a year before Cardan's rule concerning cubic equations came out, he published at Nuremberg, in Latin, the 'Arithmetica Integra,' which is his principal work. It is divided into three books, of which the first is a treatise on arithmetic; the second, a commentary on Euclid's tenth book; and the third, a treatise on algebra. He appears to have been the first who used the signs + and − between quantities, in order to indicate addition and subtraction: the first power of the 'res' (the unknown quantity) in an equation he designates the root of the equation, and represents it by a letter of the alphabet: he employs the initial letters of the words, and also the numbers 2, 3, &c., both positive and negative, to denote the corresponding powers of the quantities to which they are affixed, and he calls the numbers so applied the exponents of the powers, as they are called at present. He uses the radical sign to designate a root, but he has no mark to denote equality, the word itself being employed for that purpose.

In one of the chapters he demonstrates, from the nature of arithmetical and geometrical progressions, that the addition and subtraction of the exponents of powers correspond to the multiplication and division of the numbers whose powers they indicate; and this may be considered as one step towards the discovery of logarithms: but in expressing the exponents of the higher powers of quantities, he combines those of the lower powers by multiplication instead of addition: this last method was that of Diophantus. Thus, in order to denote the sixth power of any quantity, he uses terms indicating the square of the cube, instead of terms expressing the sum of two third powers. His method of resolving quadratic equations is by completing the square, as is done at present.

He treats at some length of what are called triangular numbers, that is, of adjacent columns of numbers constituting various progressions: thus the numbers in the first column may form an arithmetical progression beginning with 1, and having unity for the common difference; the second column may begin with 3, and the successive differences of the numbers may be 3, 4, 5, &c.; the third column may begin with 10, and the successive differences may be 10, 15, 20, &c., and so on, the head of each column being opposite to the like number in the adjacent column preceding it. He explains the use of the table in discovering the coefficients of the several terms in any powers of a binomial quantity, and in extracting the roots of numbers; and it may be observed that such tables have since been made to serve several other useful purposes in mathematics.

Stifel wrote also a treatise on the calendar, and a tract on 'magic squares.' Like many other learned men of that century, he appears to have spent much time in studying the 'Apocalypse,' and he is said to have predicted that the end of the world would take place in the year 1553. One of his countrymen, also a mathematician, had previously assigned for the time of that event the year 1524; and in Britain, the celebrated Napier found out that it would occur between the years 1688 and 1700.

Stifel died at Jena, in 1567.

STIGAND, a Saxon prelate, in great favour with Edward the Confessor, who made him bishop of Elmham, or more properly of the East Angles, the seat of which bishopric is now at Norwich. This was in A.D. 1043. Four years after he was translated to Winchester; and in 1052 the archbishop of Canterbury, Robert 'Gemeticensis,' being driven into exile, but not formally deposed, Stigand was made archbishop. This was considered an intrusion and irregularity: but the scandal was the greater, inasmuch as Stigand retained his bishopric of Winchester, holding at the same time both those high dignities. He is charged, in consequence of this, with having been inordinately avaricious and ambitious; but this defence has been made for him, that his hold was firmer on the bishopric of Winchester than on the archbishopric, from which he might have been removed had Robert returned. It is said to have been by a stratagem, of which he was the contriver, that the people of Kent obtained from the Conqueror a ratification of some of their antient customs. The Conqueror disliked him; refused to allow him to place the crown on his head; and forced him to accompany him when he returned to Normandy. Finally, the king prevailed upon the pope to send three cardinals to England to inquire into the conduct of Stigand: and several things being proved against him, he was deprived of his dignities and degraded from the clerical order. He was also condemned to perpetual imprisonment; but soon died, being, as is said, starved to death, either by the cruelty of others or by his own voluntary act. He died at Winchester, and was buried there. Lanfranc succeeded him.

STIGMA, in Botany, one of the three parts into which the central organs of the flowers called carpels are divided. The term pistil is applied to these organs, whether there is but one or many of them, or whether they are united or separate. The carpel consists of three parts: the *ovary* or germen, generally of a spherical form, and hollow, containing the ovules; the *style*, an elongated organ, formed of a continuation of the tissue of the ovary, possessing a canal in communication with the interior of the ovary; and the *stigma*, which is the point or summit of the style. The carpels, like all other parts of the flower, are modifications of the leaf, and examples of their reversion to their normal form are not unfrequent. This is well seen in the double cherry, in which the pistil often appears as a little leaf in the centre of the flower. The blade of the leaf corresponds to the ovary of the carpel; the midrib, which is elongated, to the style; and the stigma is nothing more than a secreting surface at the point of the style, communicating with the interior of the ovarial leaf. The carpel presents two sutures, called *dorsal* and *ventral*. The first of these corresponds with the midrib of the leaf, and the latter with the folded margins. The ventral suture is always opposite the axis of the plant, and is the point from which the *placenta* is developed, to which the young ovules are attached.

When there is only one carpel in the flower, it is called a simple pistil; but when there are several carpels, they are called a compound pistil. The carpels of a compound pistil may be either united or separate. When they are united, they are called by Lindley *syncarpous*. This union may occur between the ovaries only, leaving the styles distinct, as in *Nigella damascena*: or the ovaries, styles, stigmas, and all may be united, forming one body, as in the tulip. When the carpels are all separate, as is seen in Caltha, Ranunculus, &c., the pistil is said to be *apocarpous*.

The *style* is not at all essential to the existence of the carpel, and is frequently absent. When present, it is composed of just the same tissues as the ovary, which in most cases consist of vascular surrounded by cellular tissue. The style varies in form and size; sometimes it is flat, as in the Iris and Canna, but is mostly cylindrical and filiform. It generally proceeds from the apex of the ovary, but in some cases, from an alteration in the position of the ovary, it proceeds from other parts besides the apparent apex, as from the side in Alchemilla, and from the base in Lamiaceæ and Boraginaceæ. The length of the style varies very much; in some plants, as in Colchicum, it is seven or eight inches long, whilst in the Nymphæaceæ and Papaveraceæ it can hardly be said to exist at all. The canal of the style was first discovered by Malpighi. It is a continuation of the cavity of the ovary, and terminates in the surface of the stigma. This canal varies in extent in different plants, in some being very narrow, and in others very wide. It is lined with a peculiar kind of cellular tissue, having a papillary character, and is covered with a viscous secretion. It is called by Brongniart *tissu conducteur*, or conducting tissue, on account of its supposed office in conducting the pollen tubes from the stigma to the ovule.

The style is often covered with hairs, which, on account of their supposed office of clearing the pollen from the cells of the anthers, have been called *collectors*. Sometimes these hairs are united together into a kind of cup around the stigma, as in Goodeniaceæ, when they form what is called an *indusium*.

The stigma is composed of the same kind of tissue as the interior of the canal of the style, but has a more spongy appearance. Its papillary character also is more evident, and the little swellings on its surface are often called papillæ. These papillæ become less evident as the canal of the style approaches the ovary. The stigma assumes a variety of forms, the distinction of which is often of importance in systematic botany. These forms depend principally upon the tissue of which its surface is composed. Sometimes the papillæ are developed into little hairs, as is seen in the stigma of *Urtica urens*. In other cases it is perfectly smooth, as in Nymphæaceæ. In rhubarb it is composed of

three flat orbicular disks. In grasses it is in the form of a tufted hairy body like a little brush. In Mimulus it has two lips which have the power of contracting, and in Clarkia it consists of four broad lobes. In Orchidaceæ it has a structure in accordance with the anomalous character of all the parts of the flower in these plants; it consists of an oval humid space which occupies the middle of the central column, and is covered with a thick viscous secretion. In some cases however the stigma is not distinguishable from the style, as in Asclepias and Tupistra.

The position of the stigma is sometimes anomalous. As it forms the apex or point of the carpellary leaf, it ought always to be alternate with the placentæ, which are formed at the margins of the leaf, but in Cruciferæ the stigmata are opposite the placentæ. This may be explained in two ways. Dr. Lindley supposes that in this order there are originally four carpels, two of which being abortive, the stigmata are left opposite the placentæ. Brown on the contrary supposes that the stigmata are originally two-lobed, and that the lobes have united on each side, and thus obtained their abnormal position.

For the function of the stigma see IMPREGNATION, and POLLEN.

STILAGINA'CEÆ, a small natural order of plants belonging to the rectembryose group of apetalous Exogens. They are trees or shrubs, with alternate, simple, stipulate leaves, the stipules being deciduous. The flowers are unisexual, mostly seated on amentiform spikes or racemes. Calyx 3-5 parted; stamens 2 or more, arising from an enlarged receptacle with capillary filaments and 2-lobed anthers dehiscing transversely; ovary superior, stigma sessile; fruit a drupe with one seed, which is pendulous; the embryo is green, lying in the midst of fleshy albumen.

The species of this order are all of them natives of the East. In its relations this order is obscure. It has some resemblance to Urticaceæ, from which it is distinguished by its enlarged disk, its peculiar anthers, and unelastic filaments. In these characters it resembles Henslowiaceæ, but they differ from this order in having but one carpel and a single seed. Many of the fruits of this order have a pleasant subacid flavour, and are eaten by the natives of the East Indies.

STILA'GO, a genus of trees sometimes united with, at other times separated from, the genus Antidesma, belonging to the natural family of Antidesmeæ, which by some botanists is called Stilaginaceæ. The species are few in number, forming shrubs and moderate-sized trees, which are found in Madagascar and Mauritius, as well as in some of the Indian islands, and in India, where the species extend even to northern parts. The genus is characterised by having diœcious flowers, the male having a 3- or 5-parted perianth. Stamens 2, 3, or 5, inserted in an annular disk with the rudiment of an ovary. The female flower has the perianth of the male, and the disk surrounding the base of the ovate single-celled ovary. Ovules 2, pendulous from the apex of the cell. Stigma sessile, 3 to 5-rayed. Drupe one-seeded, crowned by the stigma, with the nut rugose both inside and out. Albumen fleshy, scrobiculate. Cotyledons foliaceous. Embryo inverse. The flowers are arranged in axillary catkin-like spikes. The leaves of Antidesma alexiteria are employed in the Isle of France as an antidote against snake-bites. Cordage is made with its bark, as well as with that of A. zeylanica in Ceylon. The small fruits of both species are eaten and preserved: the fruits of A. pubescens (Stilago), Bunias, and Diandra are eaten by the natives of India.

STILBA'CEÆ, a small natural order of plants belonging to the nucamentose group of monopetalous Exogens. They are small shrubs, with the habit of a Phylica or a fir, having whorled close narrow entire leathery rigid leaves, articulated at the base and without stipules. The flowers are arranged in dense spikes at the points of the branches; they are sessile, each having three bracts at its base. They differ but little from Selaginaceæ except in their 2-celled anthers, their erect ovules, and in the want of an hypogynous disk. Kunth, who formed this order, points out also its relation to Globulariaceæ, and places it intermediate between that order and Selaginaceæ. The order consists of only two genera, *Stilbe* and *Campylostachys*, both of which are natives of the Cape of Good Hope. Their properties are not known.

STI'LICHO, FLAVIUS, was of Vandal origin, and his father had been a military officer in the reign of Valens. Concerning his early life and youth we know nothing beyond the vague eulogies of Claudian (*De Laud. Stilich.*, i. 42, &c.). According to the poet's account he distinguished himself in early life in a manner which announced his future greatness. He was of an unusually tall stature, and his appearance commanded respect. When he had scarcely arrived at the age of manhood, he was sent by the emperor Theodosius to negotiate a treaty with Persia. He discharged his duties as ambassador, and maintained the dignity of the Roman empire; and after his return the emperor rewarded him with the hand of Serena, his niece, whom he had adopted as his daughter. (Claud., *Laus. Seren.*, *De Laud. Stilich.*, i. 71, &c.) Stilicho was raised from one high office to another, until at last he became master-general of all the cavalry and infantry of the Western empire. In all his military undertakings he set a noble example of honesty, integrity, and valour, combined with wisdom. Even his enemies owned that he was inaccessible to bribes. The distinctions which were conferred upon him excited the envy and hatred of Rufinus, to whom Theodosius had entrusted the administration of the East, and Stilicho would perhaps have fallen a victim to his intrigues, if Serena had not protected her husband at the court while he was at the head of the armies of Rome.

In the year A.D. 393, when Theodosius made war upon Eugenius, who with an army of Franks and Alemanni occupied the passes in the Alps between Pannonia and Italy, he placed Stilicho and Timasius at the head of the Roman forces. Eugenius was defeated and slain in the year following in a battle near Aquileia. (Oros., vii. 35; Gregor. Turon., ii. 9.) Before his death Theodosius divided the empire between his two sons, Arcadius and Honorius, the former of whom, then eighteen years old, was to govern over the East under the guidance of Rufinus; and the latter, only eleven years old, over the West, under the guardianship of Stilicho. According to the flattering account of Claudian, the emperor entrusted to Stilicho alone the care of his two sons and of the empire. (Zosim., v. 1.) Young Honorius trifled away his time in the palace of Milan, and Stilicho was in reality the sovereign of the Western empire. Stilicho has been blamed for having neglected the education of Honorius, but there is not the slightest evidence of any talent or intellectual capacity in the prince. After the death of Theodosius, Stilicho hastened through Rhaetia and down the Rhine, inspected the country and the garrisons, and renewed the treaties with the Alemanni and Franks. With the exception of Count Gildo in Africa, who even during the last years of the reign of Theodosius had endeavoured to make himself independent in his province, the whole of the Western world acquiesced in Stilicho's authority. Rufinus was the enemy from whom Stilicho had to fear most. Great numbers of the troops who had been employed in the war against Eugenius, were still in Italy, and Rufinus, anxious that they should be withdrawn from that country, is said to have invited Alaric, king of the Visigoths, to invade Thrace and Moesia, which would oblige Stilicho to send these troops to the East. Stilicho appears to have entertained the design of uniting the two empires again, and he determined to lead the troops to Constantinople himself. But Rufinus, alarmed at the approach of his rival at the head of an army, induced the emperor Arcadius to declare that Stilicho should be considered an enemy of the empire if he advanced any farther. Stilicho retired, but secretly he determined to revenge himself upon Rufinus. His soldiers were attached to him, and he could place full confidence in them; he left the command to Gaina, a Gothic prince, and at the same time gave him instructions to seize Rufinus, and to put him to death. The soldiers were easily persuaded to lend their assistance in the execution of this design. When Gaina and his army had reached Constantinople, and Rufinus with the emperor was reviewing the troops, he was surrounded by the soldiers and cut down on the spot (November, 395). The people of Constantinople rejoiced at their deliverance from the oppressor. Stilicho thus got rid of his mortal enemy at Constantinople, but a new one sprang up in his place. Eutropius, a eunuch, gained the unlimited confidence of Arcadius, and Gaina, the faithless barbarian, also deserted the cause of Stilicho, and was rewarded for it with a high office in the Eastern empire. These two new enemies of Stilicho, as long as they were united, left no means untried to deprive their adversary of the confidence of Honorius, and of the attachment of the subjects of the Western empire. His life was repeatedly endangered by assassins, and a decree was issued by the senate of Constan-

tinople, by which he was declared an enemy of the empire. Stilicho was wise and moderate enough not to involve the two empires in a civil war on this account.

Alaric, who had in the meanwhile invaded, ravaged, and plundered Greece, had penetrated as far as Peloponnesus in A.D. 396. Stilicho went with a fleet to Peloponnesus; but Alaric escaped with his Goths, was received by Arcadius into the service of the East, and made commander of all the forces of Illyricum, as far as it belonged to the Eastern empire. (Zosim., v., 7; Claudian, *De Bell. Get.*) On his return to Italy, Stilicho began, in 397 A.D., his preparations for the war against Gildo in Africa. Thinking that his presence was necessary in Italy, partly to protect the northern and eastern frontiers, and partly to provide Italy with supplies of corn, he entrusted the command to Gildo's own brother Mascezil, who was the bitterest enemy of his brother. The army of Mascezil amounted to about 5000 men, but they were mostly veterans who had served under Eugenius. Gildo had assembled a numerous undisciplined body to repel the attack, but it was routed, and Mascezil gained an almost bloodless victory. Gildo was seized, and sentenced to death, with a great number of his adherents. (Oros., vii., 36; Claudian, *De Bell. Gildonico.*) This important campaign was completed in one winter. Soon after his return to Milan, Mascezil, while riding by the side of Stilicho, was thrown from his horse into the river and drowned, and the enemies of Stilicho spread the report that by a peculiar look he had prevented the attendants from saving the unfortunate prince. According to other accounts, Mascezil was put to death for having violated the sacred character of a church. Soon after these events Honorius was married to Maria, the daughter of Stilicho and Serena. (Claudian, *De Nupt. Honor. et Mariæ.*)

Alaric had availed himself of his position in Illyricum to strengthen himself, and secretly matured his designs, while externally he kept up a good understanding with the courts of the East and of the West. At length, in A.D. 400, he set out on his march against Italy. The immediate cause of this invasion is not known. When Alaric advanced towards Aquileia, all Italy was in consternation, and the counsellors of Honorius advised him to seek a refuge in some foreign land. Stilicho alone did not share their despair. But the difficulty was to raise an army, as most of the troops were engaged in Rhaetia. Stilicho hastened thither, and was soon enabled to send the troops from Rhaetia to Italy. He also drew reinforcements from Gaul and other parts of the empire, and engaged some of the nations with whom he made peace to assist Honorius. Alaric appears to have been checked in his progress by the siege of Aquileia, and to have withdrawn towards the Danube to reinforce himself; but before Stilicho returned from his expedition, in which he assembled his forces, Alaric, in 402, advanced towards the imperial residence of Milan. Honorius fled to Asta in Liguria, where he was besieged by the Goths, and would have fallen into their hands if Stilicho had not arrived just at the critical moment with his army. He forced his way through the camp of the enemy, and saved his sovereign. The Goths withdrew, and pitched their camp near Polentia, and while they were engaged here in celebrating the feast of Easter, Stilicho attacked them unexpectedly in their camp. A bloody struggle ensued, in which the barbarians were defeated (403). The whole camp of Alaric, and even his wife, fell into the hands of the Romans. Claudian (*De Bell. Get.*) compares this victory with that of Marius over the Cimbri, although from other sources we learn that Stilicho gained the victory with great loss, while some authors even state that he was defeated. These latter accounts are the more probable, as Alaric marched from Polentia towards the Apennines to attack Etruria and Rome. This induced Stilicho, according to Claudian, to enter into negociations for peace with Alaric, as he was unwilling to stake the existence of the empire on another battle. A peace was concluded, and Alaric retreated across the river Po. Stilicho however, mistrusting the Goth, sent a small corps of observation after him, and appears to have carried on a secret correspondence with some of the Gothic chiefs in Alaric's army, so that he was informed of all that was going on. Alaric intended on his march to make himself master of Verona, but when he approached this city he found himself suddenly surrounded by the imperial troops whom Stilicho had sent thither. Alaric is said to have lost here as many of his men as at Polentia, and he himself was nearly made a prisoner. Stilicho concluded a fresh treaty with him, and allowed him to depart from Italy.

After the delivery of Italy, Honorius and Stilicho solemnized a triumph at Rome with great pomp and splendid games. The hostile machinations against Stilicho were still going on at the court of Constantinople, and he saw no better way to secure himself against them than by entering into an alliance with Alaric and engaging Honorius in a war with his brother. Stilicho intended to acquire for his sovereign possession of the eastern part of Illyricum, and Alaric was to assist him in carrying out this design, on condition that he should receive certain subsidies. (Zosim., v. 26.) The execution of these plans was interrupted, in A.D. 405, by the invasion of Radagaisus, who entered Italy at the head of several Germanic tribes, which formed an army of above 200,000 men. The safety of Italy rested again in the sword and the wisdom of Stilicho; he again drew all the military forces from the provinces to Italy, and reinforced their numbers by fresh levies. But with all his exertions he could not raise more than 40,000 men, exclusive of some foreign auxiliaries consisting of Huns under Uldin and Goths under Sarus. Radagaisus and his hordes crossed the Po and the Apennines, and marched into Etruria. Stilicho assembled his forces in the neighbourhood of Pavia. Many cities were pillaged and destroyed by the barbarians, but the siege of Florence checked their progress towards Rome. At the moment when Florence was on the point of being reduced, Stilicho surrounded the barbarians, who were encamped on the heights of Fæsulæ, with strong lines of circumvallation, while plentiful supplies were introduced into Florence. The enemy was finally reduced by famine, thirst, and disease. Radagaisus fell into the hands of Stilicho, and was put to death, and his barbarians were sold as slaves. (Oros., vii. 37; Zosim., v. 26; Augustin., *Serm.* cv., 10; *De Civit. Dei*, v. 23; Marcellin. *ad A*, 406.)

The province of Gaul, from which Stilicho had been obliged to withdraw the garrisons, was invaded and ravaged, about the end of A.D. 406 and the beginning of 407, by Vandals, Alani, Suevi, Burgundians, and other Germanic tribes. In Gaul these barbarians were opposed by Constantine, a man who had shortly before been raised from the condition of a common soldier to the rank of emperor by the soldiers in Britain, and now made himself master of Gaul and Spain by entering into a league with some of the barbarians. Stilicho indeed sent Sarus, the Goth, to Gaul, but without success, and Honorius was for a time obliged to leave the rebel in the undisturbed possession of his conquests.

Alaric in the mean time became impatient, and having advanced with his army as far as Aemona on the frontiers of Italy, he sent ambassadors to Ravenna to demand the promised subsidies. When the ambassadors arrived, Stilicho left them at Ravenna and went to Rome, where Honorius was then staying. Stilicho, who was convinced that it was dangerous to make such a formidable neighbour as Alaric an enemy, was willing to continue the peace with him, and to grant his requests. He laid the matter before the Roman senate, which, with a spirit not unworthy of antient Rome, declared that the demands of the Goth should not be complied with, and that destruction would be preferable to such disgrace. The influence however of Stilicho and his party, whose object only was to preserve Italy from new devastations at a moment when Gaul was in the hands of a rebel and of barbarians who might easily be induced to march southward, was so great, that nearly all the senators at length were obliged to give way, and 4000 pounds of gold were granted to Alaric under the name of a subsidy. (Zosim., v. 29.) The desire of Stilicho to maintain peace with Alaric was interpreted by his enemies as a treacherous partiality for the enemy of the empire, and all the calamities under which Italy had been suffering were imputed to Stilicho. Even Honorius now began to fear and suspect his minister; and this feeling was fostered by a cunning hypocrite of the name of Olympius, whom Stilicho himself had introduced to the court, and who had gained the confidence of the emperor.

In May, 408, Arcadius died, leaving a son, Theodosius, eight years old. Honorius proposed a journey to the East to regulate the administration. Stilicho represented to him the difficulties and dangers of such an undertaking, and in consequence it was determined that Stilicho should go to Constantinople. An army, which was to march against Constantine, was assembled near Pavia, and Honorius went thither to inspect it, while Stilicho was making preparations

at Bologna for his departure. The eunuch Olympius represented to the emperor that Stilicho was conspiring with Alaric, that he intended with his assistance to raise his son Eucherius to the throne, and that it formed part of their design to restore paganism in the empire. (Olympiodorus, *ap. Phot. Cod.*, 80.) He also contrived to influence the soldiers at Pavia, who revolted, and on a given signal killed several of their principal officers, who were represented to them as the friends of Stilicho. As soon as the intelligence of the revolt at Pavia had arrived, Stilicho's friends advised him to march against his enemies; but he hesitated till it was too late. His friends, for the most part barbarians, left him with indignation at his want of resolution. At midnight, Sarus, the faithless Goth, made an attack upon Stilicho's tent, and cut down his guards. Stilicho escaped to Ravenna, and took refuge in a church. He was treacherously induced to come out, and as soon as he had left the threshold he was put to death by Count Heraclian, who was waiting for him with a band of soldiers, on the 23rd of August, 408. His family and his friends were persecuted, and many of them put to death. (Zosim., v. 34.)

The history of Stilicho has come down to us in a manner which scarcely enables us to choose a due medium between the extravagant praise of Claudian and the charges of his enemies, or of such writers as were obliged to join in the general clamour that was raised against him after his fall.

(Mascow, *History of the Antient Germans*, vol. i., book viii., sect. 2, 19, English translation; Gibbon, *History of the Decline and Fall of the Roman Empire*, chap. 29 and 30; C. F. Schultz, *Flavius Stilicho, ein Wallenstein der Vorwelt, ein Beitrag zum letzten Theile der Röm. Geschichte*, Altenburg, 1805, 8vo.)

STILL. [DISTILLATION.]

STILLING, JUNG JOHANN HEINRICH, a celebrated German Pietist, born at Grund, in Westphalia, 1740. His father Wilhelm Jung was a charcoal-burner, to which trade he was also destined, but circumstances favouring his becoming a tailor, he chose that business, though he soon relinquished it for a situation as teacher at a school. Dissatisfied with this, he returned to tailoring, and continued it till several of the gentry befriended him, and took him as private tutor to their children. He contrived to save a little money, which enabled him to pursue his studies, and went in consequence to Strassburg, and studied medicine there. It was here he became acquainted with Göthe, who took a great liking to him, and has sketched his character with great fondness in several passages of the 'Dichtung und Wahrheit' (books ix. and x.). It was at Göthe's suggestion that he wrote his interesting autobiography (*Lebensgeschichte*), to whom he had often related it. Stilling practised as physician for some time in Eberfeld, and in 1778 was appointed professor at the Kameralschule of Lautern, and in 1787 at that of Marburg, and in 1803 at that of Heidelberg. He died in Karlsruhe, 1817.

As a physician, Stilling's great talent was in diseases of the eye, and he is said to have restored upwards of 2000 persons to better sight. As a writer, he was very popular, and the sect of Pietists in Germany (somewhat similar to our Methodists) look up to him with great affection. 'The great element of his character was an invincible and intense faith in God and an immediate providence, ever at hand in the time of trouble, and which momently preserved man from evil.' The most celebrated of all his works is the 'Theorie der Geisterkunde,' which we believe has been translated into English. A complete edition of his works was published at Leipzig, in 1835, in 13 vols. 8vo., edited by Dr. J. Grollmann.

(Stilling's *Lebensgeschichte*; Göthe's *Dicht. und Wahrheit*; *Conversations Lexicon*.)

STILLINGFLEET, EDWARD, son of Samuel Stillingfleet, was born at Cranbourn, in Dorset, on the 17th of April, 1635. He was educated at the grammar-schools of Cranbourn and Ringwood, and at St. John's, Cambridge. He entered the college in 1648, and obtained a fellowship in 1653. After taking his degree of M.A. he was private tutor successively in the families of Sir Roger Burgoin, at Wroxhall, in Warwickshire, and of the Hon. Francis Pierrepoint, of Nottingham. Here he began his 'Irenicum.' In 1657 he was presented to the rectory of Sutton by Sir R. Burgoin.

Stillingfleet commenced his public life as the advocate of moderate, almost of latitudinarian opinions on ecclesiastical affairs. In the year 1659 he published his first work, which was entitled 'Irenicum, or the Divine Right of particular Forms of Church Government examined.' A second edition appeared in 1662, with an appendix on the Power of Excommunication. This work, which was intended to prove that no particular form of church government is appointed in the New Testament, was thought by the high church party to savour of Presbyterianism; and in deference to them, according to Bishop Burnet, Stillingfleet afterwards retracted it. Stillingfleet himself says that 'there are many things in it which, if he were to write again, he would not say; some which show his youth and want of due consideration; others which he yielded too far, in hopes of gaining the dissenting parties to the Church of England.' (Quotation in Orme's *Life of Baxter*, p. 628; and in Stillingfleet's *Life*, p. 12.)

The work on which his reputation mainly rests is his 'Origines Sacræ, or Rational Account of the Christian Faith as to the Truth and Divine Authority of the Scriptures,' which was published in 1662. He meant to have continued it, but died before he could do so. The additions to the folio edition, published after his death, are of little value. This work is still one of the most valuable defences of the truth of the Scriptures, though it is more adapted to the theologian than to the general reader.

Stillingfleet was a fierce and indefatigable polemic. During the greater part of his life, he had his hands full of controversy, with the Romanists on the one side, and the Nonconformists on the other. In the year 1664 he engaged, at the request of Dr. Henchman, bishop of London, in the defence of the views maintained by Laud in his conference with Fisher the Jesuit. A work having been published on this subject in Paris, entitled 'Labyrinthus Cantuariensis,' with the design of proving the Church of England to be schismatical in her separation from Rome, Stillingfleet defended the Church of England, and retorted upon Rome the charge of schism in 'A rational Account of the Grounds of the Protestant Religion,' which was received with great favour by Protestants.

In 1665 he was presented by the earl of Southampton to the rectory of St. Andrews, Holborn, having been already appointed preacher at the Rolls chapel. This preferment was speedily followed by his appointment as lecturer to the Temple, and also as chaplain in ordinary to Charles II. In 1668 he took the degree of D.D., and was nominated by Charles, in 1670, canon residentiary of St. Paul's, and in 1678 dean of the same cathedral. In the meantime he published his 'Discourse concerning the Idolatry practised in the Church of Rome, and the Hazard of Salvation in its Communion,' 1671; and other tracts against the Roman Catholics, and also against the Socinians, as well as 'A Letter of Resolution to a person unsatisfied about the Truth and Authority of the Scriptures.'

In the year 1680 he plunged into a new controversy, by preaching before the lord mayor a sermon, on *Philip.* iii., 16, which he afterwards published, entitled 'The Mischief of Separation.' This sermon consisted of a violent attack on the Nonconformists, which was little expected from the author of the 'Irenicum.' Mr. Orme justly observes that 'the rector of Sutton, who wrote the "Irenicum" when the Church of England was but a sect among other sects, was a very different person from the dean of St. Paul's exposing the unreasonableness of separation from an apostolic church in all its glory. The one publication breathes a spirit of moderation, and uses the language of entreaty; the other is stern, severe, and uncompromising.' (Orme's *Life of Baxter*, p. 632.) In this discourse Stillingfleet maintains the curious position that 'though the really conscientious Nonconformist is justified in not worshipping after the prescribed forms of the Church of England, or rather, would be criminal if he did so, yet he is not less criminal in setting up a separate assembly.' The sermon was replied to by Owen, Baxter, Howe, and other eminent Nonconformists. Howe directed his attention chiefly to the above position, and added some remarks concerning Stillingfleet himself, giving him such full credit for piety, purity of motive, and general moderation, that the dean confessed 'that Howe had discoursed gravely and piously, more like a gentleman than a divine.' (Rogers's *Life of Howe*, p. 251-266.) Stillingfleet replied to his opponents in a large quarto volume, entitled 'The Unreasonableness of Separation,' 1681, in which he traces the history of Nonconformity; and Baxter rejoined in 'A second true Defence of the mere Nonconformists, against the untrue Accusations, Reasonings, and History of Dr.

Edward Stillingfleet,' 1681, to which the dean made no reply, though several writers carried on his side of the argument. A full account of this controversy is given by Mr. Orme in his 'Lives of Owen and Baxter.'

In 1685 Stillingfleet published his 'Origines Britannicae, or Antiquities of the British Churches,' which gives a full account of the early ecclesiastical history of Britain, from the first introduction of Christianity to the conversion of the Saxons. He rejects many of the traditions respecting the British churches, but is disposed to believe in the alleged visit of Paul to Britain.

When James II. revived the court of ecclesiastical commission, Stillingfleet refused to be a member of it; and after the Revolution he published 'A Discourse concerning the Illegality of the Ecclesiastical Commission, in answer to the Vindication and Defence of it,' 1689. Under Charles and James he was prolocutor of the convocation.

After the Revolution of 1688, Stillingfleet's services to the Protestant cause were rewarded with the bishopric of Worcester, to which he was consecrated in 1689. He immediately addressed himself, with his usual ardour, to correct the irregularities which had arisen in the diocese: he appeared with distinction in the House of Lords; and he still found leisure for polemics. In 'A Vindication of the Trinity, with an Answer to the late Objections against it from Scripture, Antiquity, and Reason,' he made some objections to Locke's definition of substance, and to his theory of ideas in general, which gave rise to a sharp contest between him and Locke.

Stillingfleet died of gout, at Westminster, March 27, 1699. His remains were interred in the cathedral of Worcester, where a monument was erected to him by his son, with a long and highly eulogistic Latin epitaph by Bentley, who was his chaplain.

The character of Bishop Stillingfleet has always commanded the praise even of his opponents, and perhaps many will find a more genuine expression of his worth in Howe's testimony than in Bentley's epitaph. His works prove his industry and learning. Besides the works noticed above, he wrote several theological pamphlets, and a very able defence of the jurisdiction of the bishops as peers in capital cases. His works were printed in 1710, in 6 vols. folio, and a volume of his miscellaneous works was published in 1735 by his son, the Rev. James Stillingfleet, canon of Worcester.

Stillingfleet had collected a splendid library, which Dr. Marsh, archbishop of Armagh, purchased, in order to throw it open to the public in Dublin. The MSS. were bought by the earl of Oxford, and are now in the Bodleian library.

('Life of Dr. Edward Stillingfleet, late Lord Bishop of Worcester,' &c., London, 1710, 1735.)

STILLINGFLEET, BENJAMIN, grandson of Dr. Stillingfleet, bishop of Worcester, was born in the year 1702. His father, originally a physician, and one of the professors at Gresham College, afterwards entered into holy orders, and held the livings of Wood Norton and Swanton, in Norfolk, at the time of his death in 1708. His widow was left with four children in very straitened circumstances, but Benjamin was so fortunate as to obtain a good education at Norwich grammar-school, where he made considerable proficiency. In April, 1720, he entered as subsizar at Trinity college, Cambridge, where he took the degree of B.A. in 1723. Soon afterwards he quitted the University, and became tutor to the son of Mr. Wyndham of Felbrig, in whose family he remained till 1726, when he became a candidate for a vacant fellowship in his own college, but was not successful, owing, as he believed, to the opposition of Dr. Bentley.

After this disappointment he spent many years at Felbrig, and in 1737 accompanied the son of Mr. Wyndham to the Continent. On his return to England the father of his old pupil settled on him an annuity of 100*l*., on which sum and the produce of his literary labours he subsisted for three years. The friendship of Mr. Price, whose acquaintance he had made when at Rome, now enabled him to take up his abode in a small cottage near that gentleman's seat at Foxley, in Hertfordshire. An indifferent state of health first led him to pay attention to natural history, which he afterwards cultivated with great success. In 1759 he published a collection of 'Miscellaneous Tracts on Natural History,' which consisted of translations from the writings of Linnæus and his pupils, calculated to develop the principles of that great botanist. Mr. Stillingfleet's preface to this work did much towards rendering the Linnæan system popular in this country, and constitutes his chief scientific merit.

'A Treatise on the Principles and Power of Harmony,' published in 1771, which is an abridgement of Tartini's 'Trattato di Musica,' was the only other work which appeared during his life; but he left at his death six volumes in manuscript, of a collection towards a General History of Husbandry, of which an analysis is given in his biography by Mr. Coxe. Mr. Stillingfleet died in London, on December 15, 1771, leaving behind him, besides his scientific reputation, the character of an excellent scholar, an elegant poet and musician, and a most amiable and estimable man.

For further information concerning him the reader may consult Mr. Coxe's very interesting work, 'The Literary Life and Select Works of Benjamin Stillingfleet,' London, 1811.

STILLI'NGIA, a genus of plants of the natural family of Euphorbiaceæ, so named in compliment to Dr. Stillingfleet, known as an English botanist. The genus now includes the species of Sapium, and is distinguished by one of its species being the famous tallow-tree of China. The generic character of Stillingia is:—Flowers monœcious. Males aggregate. Calyx cup-shaped, crenulate, or bifid. Stamens two, inserted; filaments united at the base; anthers opening outwards. Female flowers solitary. Calyx tridentate or trifid. Ovary sessile, 3-celled; each cell with a single ovule. Style short, thick. Stigmas three, simple, spreading. Capsule, globose, tricoccous. Cocci single seeded. The species consist of milky trees or shrubs, found in the tropical parts of Asia and America, and likewise in Bourbon and Mauritius. The leaves are alternate, petiolate; petiols biglandular at the apex. Male flowers usually crowded in terminal spikes, supported at the base by a bi-glandular bract. The female flower is commonly below the spike; sometimes subsolitary on another branch.

Stillingia sebifera, or the tallow-tree of China, at one time attracted considerable attention, and was introduced into various European colonies in the East and West Indies. It may be met with in our hothouses. Dr. Roxburgh describes the plant as common in his time about Calcutta, but that it did not yield any useful product, and was therefore only an ornamental tree, being in flower and fruit most parts of the year. It is found in China on the borders of rivulets, and is also cultivated. It grows to the height of a pear-tree, having a trunk and branches like the cherry, and foliage like the black poplar, but which turns red in autumn. It was met with in Chusan by the late expedition, and seeds sent home by Dr. Cantor, which have been sown in the Horticultural Society's Garden at Chiswick. The fruit of this tree furnishes the Chinese with candles, and oil for their lamps. The seed-vessels and seeds are bruised, and then boiled in water. The fatty particles rising to the surface are skimmed off, and on cooling condense into tallow. To give it greater consistence some wax is added, together with linseed-oil, in the proportion of three parts to ten of the tallow. The candles made with it are beautifully white. Sometimes they are coloured red by the addition of vermilion. These candles are sometimes said to be coated with wax procured from another Chinese tree (probably Ligustrum lucidum), which forms an external crust and prevents them running. This tallow is also employed in medicine instead of lard.

STILPO (Στίλπων), a native of Megara, was a philosopher of the Megarian school, who lived about the year before Christ 300. Respecting his life we know very little. He appears to have enjoyed the highest estimation among his countrymen both as a man and a philosopher. Ptolemæus Soter, when he was at Megara, endeavoured to persuade him to come to Egypt, but Stilpo refused, and withdrew to Ægina until Ptolemæus had left Megara. When Demetrius Poliorcetes took Megara, he commanded his soldiers to spare the habitation of the philosopher, who, in his eyes, was the wisest of all the Greeks living. Cicero (*De Fato*, 5), apparently on good authority, states that Stilpo, who was naturally fond of wine and women, exercised such control over his passions, that no one ever saw in him any sign of indulgence in sensual pleasures.

As a philosopher, Stilpo, on the whole, followed the doctrines of the Megarian school, but he went further, and denied the objective reality of the ideas of species and genera. He asserted that the character of a philosopher consisted in perfect freedom from passions; and in this theory he was followed by his disciple Zeno, the founder of the Stoic school of philosophy. Diogenes Laertius, in his account of Stilpo

iii., c. 12), states that he wrote nine dialogues, which he characterises by the epithet 'frigid' (ψυχρός); no part of them is now extant.

(G. L. Spalding, *Vindiciae Philosophorum Megaricorum*, p. 20, &c.; Ritter and Preller, *Hist. Philos.*, p. 181, &c.)

STILT PLOVER. [PLOVERS, vol. xviii., p. 285.]

STILTON. [HUNTINGDONSHIRE.]

STIMULANTS or *Excitants* (in medicine), agents which increase vital action, first in the part to which they are applied, then of the system generally, and perhaps ultimately of some particular organ; and when this organ is a gland or secreting organ, a renewed or augmented secretion is observed. The nervous system seems to be the part which they chiefly influence, and through it the vascular, and in many cases the muscular. This is well seen in the simple effect following the employment of ammonia in a fainting fit, where the application of the vapour of ammonia, or its carbonate (smelling salts), to the nostrils, stimulates the brain, and so restores the heart's action, by which the circulation is resumed, and all parts dependent on it vivified. Aromatic vinegar, electricity, galvanism, and the sudden application of cold, have a like effect.

The agents which constitute this class, though often confounded with others, are perfectly distinct; differing from all by their sensible qualities, their chemical composition, the nature of their physiological effects, and of the therapeutic indications they are calculated to fulfil. They are often confounded with tonics [ANALEPTICS], antispasmodics, and even narcotics, to all of which they have relations of affinity, but are not identical with any. In so far as they both act on the nervous system, they have most affinity with anti-spasmodics [ANTISPASMODICS], but differ from them in as much as stimulants increase the actions which are natural to the different organs of the body; while anti-spasmodics allay or diminish inordinate or abnormal action. Nearly the same may be said of the distinctions between them and narcotics [NARCOTICS], for though the increased action excited by an agent of this class, if extreme or long continued, is followed by a greater or less degree of collapse, still this is very different from that which follows the employment of a narcotic, which is much greater, as well as more speedy. Certain articles, such as opium and alcohol, may be made to act in either way; but while opium is not unfrequently used to stimulate, alcohol is never used medically as a narcotic, though the coma and stupor which ensue from an excessive dose of it, are as profound, and often as fatal, as from an overdose of opium.

Above all, stimulants are most frequently confounded with tonics; but independently of the consideration that stimulants operate directly on the nervous system, while tonics affect the muscular and sanguiferous systems, their operation, as well as the nature of their effects, are entirely different. Stimulants render the movements generally more frequent; tonics render them stronger: stimulants, too freely or too often used, exhaust the excitability; tonics, within a certain limit, maintain it. The action of the one is immediate and transient; that of the other slow, scarcely perceptible, and progressive, but permanent. This is best seen in their effects on the stomach. Tonics render the digestion more perfect; stimulants quicken it: moreover, most tonics must be themselves digested before the system can benefit by them; while stimulants display their effects as soon as they touch the lips or reach the stomach. In many fevers cinchona bark produces no abatement of the symptoms for which it is usually prescribed, as the stomach is too weak to digest it; but capsicum or cayenne pepper given along with it, so rouses the stomach, that the febrifuge power of the bark is then manifested.

Stimulants are of two classes: the former comprise medicinal substances; the latter, warmth, cold, electricity, galvanism, and mental agents, such as music (when lively), joy, hope, &c. Many of the latter class have been already treated of [BATHING; ELECTRICITY; GALVANISM]; of the others, the effects are too familiar to require notice, except to recommend the practice of encouraging the hope of a favourable issue to his complaint in the mind of a patient, in all cases not desperate, as cherishing this feeling greatly increases the chance of recovery. The former class are divided into permanent stimulants and diffusible stimulants, the effect of the permanent being slower but more lasting, that of the others quick but transient. The first are used where a considerable and enduring power is wished to be imparted to the system, as in the convalescence from acute diseases, the other where some great and impending danger is to be obviated, as in cases of fainting, fits, or when sedative poisons are to be antagonised. In these latter instances, ammonia, alcohol in some form, or sulphuric æther, are commonly had recourse to. Permanent stimulants are generally volatile or essential oils, pure, or in the combinations in which they exist in roots, barks, or flowers, and are often highly aromatic: malt liquors may also be classed with permanent stimulants. The precise stage in the progress of fevers and other acute diseases, when antiphlogistic or reducing measures should be abandoned, and stimulants substituted, is the nicest point that a medical attendant is ever called upon to decide; and nothing more clearly distinguishes the judicious practitioner than his correct determination of this point. It may be safely asserted that more cases are lost by a premature use of them, than by delay, as the numerous relapses in fever testify. All persons recovering from severe diseases are almost in the condition of newly born children, in whom the irritability and excitability are very great. These should not be violently acted upon, but on the contrary they should be treated with the utmost gentleness and care. Sleep is a more useful restorative than any other. Stimulants are more necessary during the night than during the day, and as more persons die during that period, the use of stimulants becomes more urgent at that time. But the best and most harmless is a very strong infusion of tea, especially green, given in small quantities, every hour or two, as the danger of the case may point out.

STINGS, in Botany, a kind of hair with which many plants are furnished, which secretes a poisonous fluid, which when introduced under the skin of animals produces inflammation. Many plants are endowed with this kind of protection, the most common example of which is seen in the stinging nettles. In these plants the sting consists of a delicately elongated tube of cellular tissue, which is seated upon a gland formed of the same tissue. The poisonous fluid is secreted in this gland, and when any pressure is made upon the gland, the fluid passes into the tube, just in the same manner as the venom passes up the fang of a serpent's tooth.

In several species of the order Malpighiaceæ the hairs, which are of a peculiar stellate form, possess a poisonous gland, with which they communicate. The genus Loasa and several others are provided with this kind of armature. De Candolle remarks that in all cases where hairs are provided with secretory glands, the fluid secreted is of an acrid nature, and that this fluid is never discharged but when some foreign body presses on the point of the hair.

The poisonous secretion of the glandular hairs, like most other secretions of plants, are more powerfully developed in tropical climates. Leschenault de la Tour gives the following account of the effects of touching the *Urtica crenulata*, which was growing in the Botanic Garden at Calcutta: 'One of the leaves slightly touched the first three fingers of my left hand; at the time I only perceived a slight pricking, to which I paid no attention. This was at seven in the morning. The pain continued to increase: in an hour it became intolerable; it seemed as if some one was rubbing my fingers with a hot iron. Nevertheless there was no remarkable appearance; neither swelling, nor pustule, nor inflammation. The pain rapidly spread along the arm as far as the armpit. I was then seized with frequent sneezing, and with a copious running at the nose, as if I had caught a violent cold in the head. About noon I experienced a painful contraction of the back of the jaws, which made me fear an attack of tetanus. I then went to bed, hoping that repose would alleviate my suffering; but it did not abate; on the contrary it continued nearly the whole of the following night; but I lost the contraction of the jaws about seven in the evening. The next morning the pain began to leave me, and I fell asleep. I continued to suffer for two days; and the pain returned in full force when I put my hand into water. I did not finally lose it for nine days.' (Lindley, *Nat. Syst.*, p. 176.) These effects, though violent, are not so severe as those produced by another nettle, known in the East by the name of Devil's Leaf, which is said sometimes to produce death.

STINT. [TRINGA.]

STIPES, in Botany, a term applied to almost all parts of a plant performing the functions of a stalk, with the exception of the petiole and flower-stalk. It is frequently used to express the whole stem of a plant. The organ which

supports the pistil in some plants, as in *Capparis*, *Lunaria*, and *Colutea*, is called *stipes pistilli* by some writers, and by others Gynophorum and Gynopodium. Stipes is also applied to the setæ of some Mosses, as those of Sphagnum and Andreaceæ. The stalk that supports the pileus or cap in the higher forms of Fungi, as well as the part that supports the organs of reproduction in such Lichens as *Calicium*, *Coniocybe*, and *Bæomyces*, is called stipes. The same term has been applied, though with much less propriety, to the petioles of the leaves of ferns.

STIPPLE. [Engraving.]

STIPULES, in Botany, are those organs which are found at the base and on each side of the axils of the leaves of plants. They are not of constant occurrence, not being found in all plants, but where they occur they frequently characterise a whole family, as in Leguminosæ, Rosaceæ, Malvaceæ, &c. These organs are frequently very like leaves, and present themselves in the various forms in which leaves are found. But they are always to be distinguished from leaves by their position at the base of the leaf-stalk. In many cases they are green, like the leaf; they sometimes have petioles, and are sometimes sessile and cut into teeth, lobes, &c. In the Mimosas the stipules frequently degenerate into hardened spines. In the family of Polygonaceæ they are membranous, and being united together they form a sheath around the stem, which is called an *ochrea*. The stipules in Cucurbitaceæ assume the character of tendrils, and in *Trapa natans* they appear under the form of elongated filamentous bodies.

The size of the stipules varies greatly: sometimes they are very diminutive, and occupy but little space compared with the leaf, as is seen in the little bristle-like stipules of the bird-cherry and the withered scale-like character they present in the buckthorn; whilst in other plants they are very large, as in the hearts-ease, and sometimes they seem to develop at the expense of the leaf, and perform its functions, as in the *Lathyrus aphaca*.

The duration of stipules varies. In some cases they drop off very early, so as sometimes to lead to the supposition that they never existed. This occurs in the Amentaceæ. In many plants they continue on after the fall of the leaf, and this is especially the case in those with spiny stipules; it is also seen in many of the Rubiaceæ, &c.

The character of the stipules is frequently much altered by the adhesions that take place between them. In Magnolia they adhere together by their upper ends, and form a kind of sheath for the protection of the young buds. In some species of Astragalus the stipules of opposite sides meet, and form apparently one stipule with two teeth. This form of stipule is called *synochreate*. In *Melianthus major* the lateral stipules are united through the axil of the leaf, and thus form an intra-axillary stipule and De Candolle supposes that the occurrence of all intra-axillary stipules may be accounted for in this way. In those Geraniaceæ the leaves of which are opposite, the stipules of each side unite, apparently forming but two stipules where there are really four. In Cinchonaceæ, which possess opposite leaves, they adhere sometimes by one edge and sometimes by another; but in most instances the stipules of opposite sides grow together, forming what is called an interpetiolar stipule.

The stipules appear to be modifications of the leaves, but may always be distinguished from these organs by their being placed at the base of the leaf-stalk. Another distinction would also be found in their not possessing buds in their axils. This law however is subject to some exceptions, as stipules are sometimes found with buds in their axils, thus proving their theoretical identity with the leaf.

The function of the stipules generally is not very obvious, but in many cases there can be no doubt that they act as a protection to the young bud, as is seen in Magnolia, and more particularly in the tulip-tree (Liriodendron), where they embrace the young bud in the form of two little valves. In compound leaves the leaflets are often furnished with smaller stipules. These have been called by De Candolle *stipels*. Examples of these may be seen in the species of *Hedysarum*.

STIRIA. [Styria.]

STIRLING, WILLIAM, EARL OF, the son of Alexander Alexander of Menstrie, is generally stated to have been born about the year 1580. The only ground however upon which this opinion rests is the inscription 'ætatis suae 57' on the portrait prefixed to one copy of the edition of his poetical works, published in 1637. His father died in 1594. William succeeded, at his death, to landed property in the counties of Clackmannan and Perth, and accompanied Archibald, seventh earl of Argyle, in his travels on the Continent. Between 1603 and 1614 he published several poems. The tragedy of 'Darius' was printed at Edinburgh in 1603: it was reprinted at London in 1604, with the addition of the tragedy of 'Croesus,' a 'Paraenesis' addressed to Prince Henry, and 'Aurora,' containing the 'first fancies' of the author, and two short pieces, 'Some Verses, written by the author to his majestie, by the author, at the time of his majestie's first entering into England,' and 'Some Verses written shortly thereafter, by reason of an Inundation of Dovan, a water neere unto the author's house, whereupon his majesty was sometimes wont to hawke.' The two tragedies were again printed at London, with the addition of the 'Alexandraean Tragedy,' and 'Julius Cæsar,' in 1607. 'An Elegie on the Death of Prince Henry' was published at Edinburgh in 1612, along with 'Some verses to his Majestie,' and 'A Short View of the State of Man.' The earliest edition of 'Domesday, or the Great Day of the Lordes Judgment,' is that of Edinburgh, 1614. With the exception of two books of an unfinished poem, 'Jonathan,' Alexander published no poetry after 1614, but a pocket edition of the tragedies appeared in 1616, and 'Recreations with the Muses,' a collection of his principal poems, was published in 1637. His poetry is diffuse, deficient in point, and fails to carry the reader along with it; but the versification, though unequal, is often stately and musical, there is a vein of elevated sentiment running through the whole, and the thoughts are those of a man of learning and sound judgment. The 'first fancies' are of course sonnets to his mistress's eyebrow, but the rest are all of a didactic tendency. The opening soliloquy put into the mouth of the ghost of Alexander the Great, in the 'Alexandraean Tragedy,' contains a mixture of lofty ideas, some of them not unworthy of Lucian, which, had the diction been more condensed, must have produced a deep and startling impression. The 'Paraenesis' is curious, inasmuch as the ambitious disposition and habitual train of thought which prompted the colonising speculations of his after-life, may there be traced in their first germ. He was among the first Scotchmen who wrote English: he was Drummond's senior, and was occasionally consulted by him regarding style and rhythm. After all however the poems of Alexander seem to have been less the result of a single-minded love of song, than of a desire to attract notice and open a public career for himself. In this he was successful. Lithgow apostrophised him as 'grave Menstrie, true Castalian fire.' Drayton called him 'my Alexander,' and king James 'his philosophical poet.' His first patron was Prince Henry. On the death of that prince he transferred his services to his brother Charles, whose gentleman-usher he was sworn in 1613. In 1614 the king knighted him, and appointed him master of requests. In 1621, king James granted the territory of Nova Scotia to Sir William Alexander, by a charter dated the 10th of September. The jealousies which disturbed the latter years of James's reign prevented the further progress of Alexander's scheme of colonization till after his death. On the accession of Charles I, Sir William developed his scheme of colonization in a pamphlet entitled 'An Encouragement to Colonies,' published in 1625. An improved edition was published in 1630, under the title of 'The Map and Delineation of New England, together with a Discourse of Plantations and Colonies.' The king was so won by the project, that he made Sir William Alexander lieutenant of New Scotland, and founded, in connection with that colony, the order of knights-baronets in Scotland. The territory was to be divided into parcels not exceeding one hundred and fifty; and Sir William was entitled to dispose of them, with the title of baronet, to the purchasers, for the improvement of the colony. Alexander's idea seems to have been to establish a feudal state, of which he was to be the head, under the *suzeraineté* of the king of England. He is said to have received 200*l.* sterling from each purchaser, and the patents were ratified by parliament, and registered by the lord Lyon king-at-arms. Ultimately however Alexander was induced to cede his claims to the French; but the allegation that he was paid for doing so seems destitute of foundation. The purchasers retained their titles, which were hereditary, and gave them precedence in Scotland of all knights and minor barons. This transaction gave

rise to severe reflections on Alexander. There is every reason however to believe that he was more ambitious of founding a colony than anxious to obtain money, though nowise averse to the latter. He obtained from the king a charter of the lordship of Canada in 1628, and from the council of New England a grant of all that part of New England between the rivers Kennebeck and St. Croix, and of the island of Stirling (now Long Island, in the state of New York), in 1635. He made vigorous efforts to settle this island, and his eldest son contracted the disease which carried him to his grave before his father, by the excessive hardships he underwent in trying to found a settlement on the St. Lawrence. What property Alexander did accumulate seems to have been dissipated in these attempts; for the family estates in Scotland were snatched by his creditors from his third son. It is however pretty clear that he contrived to obtain large grants both of property and honours through the royal favour, and the temper of the times he lived in was not such as to allow such acquisitions to pass without criticism. While busied with the Nova Scotian project, he obtained the privilege of coining for Scotland a sort of base copper-money, called 'turners.' Douglas mentions, in his 'Peerage,' that Alexander having built about this time a large house in the town of Stirling, on which he inscribed his motto, 'Per mare, per terras,' his countrymen travestied it into 'per metre et turners,' in allusion to his making money by poetry and copper-coining. Besides the large grants of land in America, the king granted to him charters of the barony of Menstries, 1628; of the baronies of Largis and Tullibody, 1629; of the barony of Tullicultre, 1634, of the barony of Gartmore, 1636. He was sworn a privy-counsellor, and appointed secretary of state for Scotland in 1626; made keeper of the signet, 1627; a commissioner of Exchequer, 1628; and an extraordinary lord of session in 1631. He was created Viscount Stirling and Lord Alexander of Tullibody, by charter, dated Windsor, 4th September, 1630, and Earl of Stirling, Viscount Canada, and Lord Alexander of Tullibody, by patent, dated at Dalkeith, 14th June, 1633. William earl of Stirling died on the 12th of February, 1640. By his wife Janet, daughter of Sir William Erskine, commendator of the bishopric of Glasgow, he had seven sons and two daughters. The last of his male descendants, Henry, the fifth earl, died without issue in 1739. The earl of Stirling, who held a command in the revolutionary army of America (whose representative still votes under protest at each election of Scottish peers), claimed the title as descendant of Andrew Alexander, younger brother of the great-grandfather of the first earl, the title having been granted to 'heirs-male of the name of Alexander.'

(Kippis's *Biographia Britannica*; Horace Walpole's *Catalogue of Royal and Noble Authors*, Park's edition; Douglas's *Scottish Peerage*, Wood's edition; The Earl of Stirline's *Recreations with the Muses*.)

STIRLING, JAMES, an English mathematician of considerable eminence, but of whom, except the works which he published, scarcely any thing is known. He must have been born near the end of the seventeenth century, and he was a student in the university of Oxford; in 1726 he was elected a fellow of the Royal Society, and his death must have taken place subsequently to the year 1764.

Mr. Stirling's first work is entitled 'Lineæ Tertii Ordinis Newtonianæ, sive,' &c.: this work, which was published at Oxford, in 8vo., in 1717, contains a commentary on Newton's tract on the subject of lines of the third order. In this tract it is shown that all such lines may be expressed by four different equations, of the third degree, between two variable quantities x and y; and that of these equations one, which consists of terms involving the three first powers of x and the two first powers of y, comprehends sixty-five species of hyperbolic curves. Stirling discovered that the same equation contained two additional species, and the Abbé De Gua (*Usage de l'Analyse de Descartes*) subsequently detected in it four others which had been overlooked by Stirling, probably because he directed his researches almost entirely in the steps of his author. The English mathematician has the honour of being the first who observed, if the value of y in the given equation be found in an infinite series of terms containing descending powers of x, that on taking one term only of such series for the value of y, there is obtained an equation of the first degree, which determines the position of a rectilinear asymptote to the curve: that on taking two terms, there is obtained an equation of a curve, which may be considered as an asymptote to the original curve, and which approaches nearer to it than the rectilinear asymptote; and so on. It may be observed however that the division of curve lines into classes and species is arbitrary, Newton, Euler, and Cramer having made the number of curves of the same order very different: it is also now of small importance, since when the equation of any curve is given, the rules of analysis enable the mathematician to determine immediately its tangents, asymptotes, normals, and 'singular' points.

The work which contributed most to Stirling's reputation is his 'Methodus Differentialis, sive Tractatus de Summatione et Interpolatione Serierum Infinitarum:' this work was published in London, in 4to, in 1730; and in the first part of it there are investigated general formulæ, expressing the sums of given series by means of a factor, by which each term in a series being multiplied, the product is equal to the next following term: the factor itself is in the form of a series consisting of terms arranged according to the ascending or descending powers of a variable quantity: and for this variable are to be substituted different numbers increasing from unity. When the given series is not susceptible of having its sum expressed in finite terms, the factor is an infinite series, and then the formula expressing the sum is also an infinite series; but being highly convergent, the summation of a few of its terms gives a very near approximation to the value of the given series. The second part of the work relates to the interpolation of terms between those of any given series: the values of the interpolated terms are found agreeably to the method of Newton, and there are added several theorems for facilitating the processes by which they are obtained. There are also given various formulæ for approximating to the quadrature of curves by the method of equidistant ordinates.

In the 'Philosophical Transactions' for 1735 there is a paper by Stirling 'On the Figure of the Earth and on the Variations of the Force of Gravity at its Surface.' And a second edition of the 'Methodus Differentialis' was published in 1764.

STIRLING. [STIRLINGSHIRE.]

STIRLINGSHIRE, an inland county of Scotland. It is bounded on the north by Perthshire, from which it is in several parts separated by the river Forth; on the north-east by Clackmannanshire and a detached portion of Perthshire, from both which it is separated by the Forth, which here becomes a wide æstuary; on the east and south-east by Linlithgowshire, or West Lothian; on the south by Lanarkshire and a detached portion of Dumbartonshire: and on the south-west and west by the main portion of Dumbartonshire, from which it is separated by Loch Lomond. The form of the county is irregular; the greatest length is from north-west to south-east, from the neighbourhood of Glengyle at the head of Loch Katrine or Cateran, to the shore of the Forth near Grangemouth, 42 miles; the greatest breadth at right angles to the length is from Logie near Stirling, to the neighbourhood of Calder, not far from Glasgow, 25 miles. There are two insulated portions surrounded by Perth and Clackmannan shires, and including the parish of Alva and part of Logie parish. The area of the county is estimated at 502 square miles, or 321,280 acres, of which 13 square miles, or 8320 acres, are in lochs. (Mac Culloch's *Statistical Acct. of the British Empire.*) Dr. Playfair's estimate is 560 square miles. (*Description of Scotland.*) The population of the county at the different enumerations made during the present century was as follows: 1801, 50,825; 1811, 58,174; increase 14 per cent.; 1821, 65,376; increase 12 per cent.; 1831, 72,621; increase 11 per cent.; 1841, 82,179; increase 13 per cent. The number of inhabitants to a square mile, according to the census of 1831 (which we retain to facilitate comparison), and taking Mac Culloch's estimate of the area, was 145; it was at that time the thirteenth county of Scotland for amount of population, exceeding Orkneyshire, but falling short of Dumfriesshire; and the eighth in density of population, exceeding Ayrshire, but falling short of Forfarshire. In area it is the sixteenth county, being larger than Fifeshire but less than Banffshire. Stirling, the chief town, is 31 miles from Edinburgh Castle in a direct line west-north-west, or 35 miles by the road through Linlithgow, Falkirk, and Bannockburn. The county is included between 55° 54′ and 56° 20′ N. lat., and 3° 40′ and 4° 40′ W. long.

Surface; Geology.—The north-western extremity of the county is included in the district of the Highlands, and is occupied by the mountain-range which forms the western ex-

tremity of the Grampians, and separates Loch Lomond from Lochs Chon and Ard, in which the Forth rises. Of this range the principal mountain is Ben Lomond; 'on the north it is precipitous; on the south, setting out from the inn of Rowardennan, on the bank of the lake (Loch Lomond) you ascend easily in three hours, walking over a space of three miles. When you reach its conical summit, overtopping every surrounding eminence, and elevated 3000 feet above the level of the sea, you have on the north an endless succession of mountains like the billows of the stormy ocean; and on the south you have presented before you, as on a map, the riches and beauty of the central district of Scotland from the Western Isles to the Frith of Forth.' (*New Statist. Account of Scotland.*) At the foot of this mountain range, in Loch Lomond, are several islands, part of which are included in Stirlingshire. This range consists of primary rocks, chiefly slates. Roofing-slates frequently occur, and there is some limestone; but neither are available to any extent for economic purposes; the slates because they are too heavy to pay for land carriage, and the limestone because it is too distant from coal.

East of this district the face of the country becomes more level, and is occupied by rocks of the old red sandstone group; but in the central parts of the shire it again rises into hills, which form the group of the Lennox hills, extending from east-north-east to west-south-west from the Forth about Stirling to the Clyde near Dumbarton. They are estimated to attain in their highest part the height of 1500 feet, and present many indications of a volcanic origin. The Campsie Fells, which constitute part of the group, and skirt the valley of the Kelvin, consist chiefly of large tabular masses of trap, the geological position and character of which vary considerably. The other hills of the group, the Gargunnock, Fintry, and Kilsyth hills are chiefly trap or whinstone: the face of them is broken with crags and glens. These trap rocks appear to have penetrated through the old red-sandstone, and through the limestone and the coal formations, which toward the south-east cover the old red-sandstone. That part of the country which skirts the Lennox hills to the south and east, and is drained by the Kelvin, a feeder of the Clyde, and by the Carron and other tributaries of the Forth, belongs to the coal district of Central Scotland, and yields coal, ironstone, freestone, and limestone in considerable quantity. Silver and cobalt were formerly obtained in the detached part of the shire which constitutes the parish of Alva. The carses or dales are generally occupied by the later formations or by alluvium.

Hydrography and Communications.—The county belongs partly to the basin of the Forth and partly to that of the Clyde. The Duchray Water, one of the principal affluents of the Forth, and which some regard as the principal head of that river, takes its rise from several springs on the northern and eastern slopes of Ben Lomond, and forms for five or six miles the boundary of the county. It then enters Perthshire, but again touches the border of the county after its junction with the other principal head of the Forth; and except for a short distance in the parish of Kippen, where its course wholly belongs to Perthshire, and again near Stirling, where it wholly belongs to Stirlingshire, forms the northern boundary of the county till it receives the Avon, which forms the eastern boundary. Its course in the neighbourhood of Stirling is very winding. Its Stirlingshire tributaries are all small; the Bannockburn, the Carron, and the Avon are the principal. Some more important streams, the Teith, the Allan, and the Devon join it on the opposite bank. Up to Stirling bridge the Forth is navigable for small sailing-vessels and steam-boats. At the junction of the Carron with the Forth is the small port of Grangemouth. The Forth abounds in pike, perch, and eels; trout and salmon are not so plentiful as formerly; trout are however abundant in the streams that flow into it.

No part of the Clyde is in this county: but the Endrick and its feeder, the Blane Water, which drain the chief part of the district between the Highlands and the Lennox hills, and the Kelvin, which drains the southern part of the county, are both affluents of the Clyde. The Endrick does not indeed immediately join the Clyde, but falls into Loch Lomond, which communicates with the Clyde by means of the Leven Water. The Endrick abounds in trout. In the parish of Fintry it falls over a rock 90 feet high, presenting, when the waters are swollen by a flood, a magnificent cascade: there is a second smaller fall lower down.

The 'Great Canal,' which connects the Forth and the Clyde, has part of its course in this county. Commencing in the Forth, or rather in the Carron, at Grangemouth, it runs west-south-west into the detached portion of Dumbartonshire: its whole length is 35 miles, or with the branch to Port Dundas near Glasgow 37½: about ten miles of its course belong to Stirlingshire. The canal is on the average 57 feet wide at the top, 27 at the bottom, and nine feet deep: it has 39 locks, and admits vessels of 90 tons burden. The manufactures of Glasgow are conveyed by this canal to the eastern parts of the island; and goods of various kinds conveyed back. This canal was begun in 1768, opened to a certain extent in 1775, and completed in 1790. The Edinburgh and Glasgow Union Canal commences at Port Hopetoun basin, in the neighbourhood of Edinburgh, and joins the Forth and Clyde Canal at Port Downie, near Falkirk, about four miles from Grangemouth; its whole length is 31½ miles, partly in this county. It enters the county by a fine aqueduct bridge over the valley of the Avon, and passes near its junction with the Forth and Clyde Canal through a tunnel nearly 1000 yards long cut in the solid rock. It was begun in 1818 and finished in 1822, and is used for the conveyance of coal, manure, goods, and passengers.

The Edinburgh and Glasgow Railway passes through this county, having its course parallel to that of the Union Canal and of the Forth and Clyde Canal. The Act for this railway was obtained, and the railway itself begun, in 1838. It commences at the Hay-market of Edinburgh, and is carried across the valley of the Avon, where it enters this county by a viaduct of twenty arches, some of them 90 feet high, and terminates in George Square, Glasgow: it passes by a tunnel 845 yards long through a hill near Falkirk. There is to be a short branch to the town of Falkirk.

The Slamannan Railway, which runs from near the termination of the Ballochney Railway in Lanarkshire to the Forth and Clyde Union Canal at Linlithgow, has part of its course in this county: its whole length is about twelve miles and a half; the main line was opened in 1840.

The road from Edinburgh to Stirling, and from thence to Perth and the north of Scotland, enters this county on the east side at Linlithgow bridge, over the Avon, and runs by Falkirk, Bannockburn, and St. Ninian's, to Stirling. At Camelon, just beyond Falkirk, a road branching from this to the left runs by Kilsyth and Kirkintulloch to Glasgow, with a branch from Kirkintulloch to Dumbarton. The road from Stirling to Glasgow falls in with this road between Camelon and Kilsyth; and after coinciding with it for a short distance, turns off to the left, and runs by a more direct line to Glasgow.

Soil, Agriculture, &c.—The hilly district of the centre and the highland tract of the north-west, with the lower lands that lie between them, are in most places bleak and sterile; but the carse, or valley of the Forth, from the neighbourhood of Falkirk to Stirling, consists of low and fertile alluvial lands. The eastern side of the county presents a finely diversified appearance, and the view from Stirling Castle is of almost unequalled beauty.

In the parish of Buchanan, which comprehends nearly the whole of the highland district, with an area of above 76,000 acres, only about 1500 acres are of arable land: this consists of the alluvium on the banks of the Endrick, and on the shore of Loch Lomond. Good crops of oats and a little barley are raised here, and potatoes and turnips are grown. There are above 4000 acres of natural woods or plantations, the latter being chiefly of oak and larch. The woods, both natural and planted, are divided into twenty-four portions, and one is cut every year, so that the whole are cut every twenty-four years: they produce copse-wood, not timber, except that a few trees are left at every cutting for standards: the bark forms an important part of the produce, and a great quantity of small wood is annually consumed in a manufactory of pyroligneous acid and dye-stuffs established in the parish. The products of the manufactory are consumed in the print-works round Glasgow. The greater part of the parish is waste land, used as a sheep-walk or pasture: about 16,000 or 17,000 sheep, chiefly black-faced and of small size, are reared yearly: and about 1300 or 1400 cows or black cattle, and a very few horses.

In proceeding from the highland district towards the south-east the quantity of cultivable land increases. In Drymen, the adjacent parish to Buchanan, of 32,200 acres, about 7000 are cultivated, and are occasionally in tillage: this land is chiefly in the Strath, or valley of the Endrick,

or in the neighbourhood of the Forth. The soil in the Strath of Endrick is a rich brown loam: along the Forth are nearly 3000 acres of deep moss, called 'Flanders Moss,' under which there is a rich clayey soil, capable of producing good crops. The low flat moss lands, of which this is the commencement, and which extend along the Forth all the way to Stirling, distant sixteen miles, are supposed to have originated from the destruction of the forests cut down by the troops of Severus in his war against the Caledonians. Trees of immense size are frequently dug out, lying in various directions, and having the marks of the axe upon them. Improvements in agriculture have been generally introduced into this part of the county: a five-shift rotation of crops is generally adopted in the best lands, and draining has been extensively practised. Two-thirds of the parish consist of moor-lands, partly between the Forth and the Endrick, partly to the south of the Endrick. The small black-faced sheep, improved by the occasional introduction of Linton and Lammermoor rams, are general; but a few Leicesters are kept on the better farms. The Ayrshire breed of cattle is prevalent, though some of the mongrel breed formerly in use are still retained.

In the lower ground which separates the highlands from the Lennox Hills, and in the straths or valleys of the Forth, north of those hills, and of the Kelvin, south of them, the quantity of arable land is greater in proportion. The lower grounds are commonly divided into the carse or valley, and the dryfield or upland slope between the valley and the moorland hills. Oats and hay form the principal crops: barley and potatoes are grown to a considerable extent; and turnips, cabbages, tares, beans, and wheat in a smaller proportion. A six-year shift is the common rotation. Draining and other improvements have greatly extended, and are still extending. Milch-cows are now numerous; the Ayrshire breed is preferred. The butter made and the buttermilk find a ready market in Glasgow. Scarcely any cheese is made except for home use. Many calves are reared, though none are fattened. The hills are occupied as sheep-walks, as in the highland district; and the black-faced sheep from Tweeddale are prevalent. There are some plantations upon and around the Campsie Hills of Scotch fir, larch, spruce, ash, elm, birch, oak, lime, and plane.

The eastern part of the county is the most fertile, and, in an agricultural point of view, the most important. It comprehends the carse or valley of the Forth below Stirling, the soil of which consists principally of a bluish clay mixed with sand. There is comparatively little waste land; the soil is almost wholly occupied in tillage or in plantations: and the greater facility for obtaining manure by means of the navigation of the Forth has tended to the improvement of agriculture. A six-year shift is common; and the produce in wheat, barley, and beans is larger in proportion to other produce than in the more western districts of the county. Gardens and orchards are numerous and productive: the soil is particularly adapted to pear-trees. The horses reared are of superior description.

Rents vary. Arable land in the highland district brings about 25*s.* per acre; but the rent of a farm is commonly calculated by the number of sheep which it will keep, and is about 3*l.* to 3*l.* 10*s.* per score. In Drymen, adjacent to the highland district, the inferior arable land lets at from 10*s.* to 15*s.* per acre; and that of better quality at 2*l.* 10*s.*: the rent of a cow's grazing in the best land is 3*l.* 10*s.*; and of a hill-fed sheep 5*s.* or 6*s.* From the various quality of arable land, great variety of rent is given; perhaps 2*l.* may be taken as the average rent of arable land in the whole shire: in a few instances it rises to 4*l.*, and in some places falls as low as 7*s.* Leases are commonly for nineteen years. Grain rents are common in the lower part of the carse or valley of the Forth, below Stirling. The greatest fairs or markets for cattle in Scotland are held near Falkirk in this county: they are known as 'Falkirk Trysts.'

Wild animals abound in the wastes of the highlands. Ptarmigan and white hares are found on Ben Lomond, and the eagle is occasionally seen there. Grouse are common on the upland moors, and black game and roes are increasing. Pheasants, which were introduced by the late duke of Montrose, have spread through the whole extent of the strath of Endrick. Hares are numerous in the grounds of Buchanan House, where they are strictly preserved. Hares, rabbits, partridges, grouse (black and red), wild-ducks, woodcocks, and pheasants, are common in the Lennox Hills and their neighbourhood, and a few roes are seen: otters, weasels, stoats, polecats, foxes, and squirrels, are numerous; as are the smaller birds of prey. Pike and perch abound in the lochs in Strathblane parish, and in one of them char is found. The streams generally contain trout, and in the lower part of the Endrick the salmon is taken. Badgers and wild-cats, formerly abundant, are now extinct.

Divisions; Towns.—The shire contains twenty entire parishes, and part of five others, viz. Logie, part of which is in Perthshire, and another part in Clackmannanshire; Stirling, which is partly in Clackmannanshire; Lecropt and Kippen, which are partly in Perthshire; and East Kilpatrick, which is partly in Dumbartonshire. It contains the royal burgh of Stirling, the parliamentary burgh and town of Falkirk, the port of Grangemouth, and a number of thriving manufacturing and other villages. Falkirk is described elsewhere. [FALKIRK.]

Stirling, which gives name to the shire, is near the south bank of the Forth. A castle or tower was early erected here, under the protection of which the town grew up; and from its commanding the passage of the Forth, rose early into importance. The name was at first Stryveline or Stryveling; and has been Latinized by Buchanan and others, Starlinœum. It was made a royal burgh; its earliest known charter is dated A.D. 1119. In the twelfth and thirteenth centuries, Stirling Castle was considered to be one of the four principal fortresses of the kingdom; and is one of four which are still upheld by virtue of the articles of the Union. It appears conspicuously in the history of the English wars, and was frequently the residence of the Scottish kings.

The parliamentary burgh of Stirling comprehends the town of Stirling proper, the hamlet of Newhouse, and the village of St. Ninians, which are now united to Stirling by an almost continuous line of buildings. The royalty (or municipal jurisdiction) includes the town and immediate vicinity, but does not extend to Newhouse or St. Ninians, and indeed does not include the castle and government lands, and some lands held in trust for charitable institutions, though they are in the town. On the other hand, some portions of the municipal burgh are north of the Forth, and not within the parliamentary limits. The parish again is not exactly coincident with either the municipal or parliamentary borough. The census of 1831 gave to it 829 houses, inhabited by 1904 families: 3 houses building, and 14 uninhabited; with a population of 8556, of which but a small part was agricultural. The parish of St. Ninians had 1706 houses inhabited by 2055 families, 10 houses building, and 35 uninhabited, with a population of 9552: but from the great extent of this parish, a comparatively small part is comprehended in the parliamentary borough of Stirling. The population of this included part may be estimated at about 2000.

The town of Stirling is irregularly laid out; a winding street or road, not lined with houses throughout, leads to the bridge over the Forth, and by that towards Perth. The Castle-hill, a somewhat long and narrow ridge, is on the north-west side of the town, toward which it rises gently, but presents a steeper slope on the other sides, and is in some parts quite precipitous. The prospect which it commands is very fine. The castle presents a singular assemblage of buildings, some of them antient, but altered and adapted to the purposes of modern warfare. The palace, built by James V., is now converted into a barrack; and the adjacent hall, built by James III. for the meeting of the Scottish parliament, is now a riding-school. Adjacent to this is the chapel royal, built by James III., and rebuilt by James VI. (I. of England), now desecrated and employed as a store-room and armoury. South-west of the castle is the space formerly occupied by the king's park and garden: it is surrounded by an old wall, but is chiefly occupied as pasture or cultivated ground. A series of concentric polygonal mounds marks a spot in the garden, said to have been the scene of some forgotten diversions; a hollow, called 'the valley,' is said to have been appropriated to jousts and tournaments, which the ladies viewed from what is still a craggy pyramidal mound, called 'the ladies' hill.' To the north of the castle are a series of rocky eminences, called the Gowan or Gowlan hills, gradually descending towards the plain: the remotest of these eminences, near the bridge, was the antient 'heading-hill,' or place of execution for state criminals. The castle contains a depôt of arms, and is occupied by a regular garrison.

The more antient streets of the town are narrow, winding, and in many places ill-paved; with decayed houses: but several streets have been much improved in the present century, and are lined with good shops; and the different roads out of the town are lined with neat modern villas, Stirling being a favourite place of retirement for gentry and persons out of business. The town is lighted with gas. The old church, a fine Gothic building, stands near the castle: it has a massy tower of decorated English architecture at its west end. It was originally the conventual church of a Franciscan friary, founded by James IV. in 1494. The nave is low, with round piers and moulded arches pointed, and some good windows of decorated English character. The chancel was built by Cardinal Beaton at a later period than the rest of the building. It is lofty, with fine piers and arches: the east end is an octagon, with a curious stone ceiling. South of the church is Gowane's Hospital, built in 1639; and north of it are the ruins of a curious old house of the earls of Mar, called 'Mar's Work,' deserving of examination. There is another old house, Argyle's Lodgings, of the same period. The old bridge over the Forth is an inconvenient structure of stone, of uncertain date, but certainly as old as the middle of the sixteenth century: a new and more convenient bridge has been built just below it. The wooden bridge, which preceded the old stone bridge, was about half a mile higher up the river: there is a ford at the spot, and the remains of the bridge are still visible at low water. The town-house is an old building with a spire; behind it is the gaol. There are commodious corn and meat markets, and a handsome building, the Athenæum, devoted to literary purposes.

The chief manufactures are of tartan and tartan shawls, carpets, yarns, cotton goods, malt, leather, soap, and candles. There are dye-houses for yarns, home-made cloths, and silks, rope-yards, and breweries. Considerable trade is carried on in corn, wood, coals, bricks, tiles, lime, and wool. About a hundred vessels are said to be engaged in the trade up the Forth to Stirling; and there is constant communication by steam with Newhaven, near Edinburgh, and the intermediate places on the Forth. The market is on Friday, and there is a weekly cattle and horse market between Christmas and Whitsuntide. There are five banking establishments. The circuit court for Stirling, Clackmannan, and Kinross shires, the sheriff's court, and the burgh court are held here.

The burgh council, under the act 3 & 4 William IV., cap. [illegible], consists of a provost, four bailies, a treasurer, and fifteen [illegible] councillors. The corporations are the guildry or merchants, seven incorporated trades, and four other bodies, called 'tolerated communities.' The burgh revenue is above 2000*l.* per annum: the debts amount to about 11,000*l.* Stirling unites with Inverkeithing, Dunfermline, Queensferry, and Culross in returning a member to parliament.

There are two churches of the establishment, formed by dividing the old church, already noticed; each is capable of accommodating nearly 1200 persons; and it has been proposed to erect a third. There are three parish ministers. They hold an evening service in an ex-Cameronian meeting-house. There are two United Secession congregations, one Reformed Presbyterian, one Independent, one Baptist, one Scotch Baptist, one Original Burgher congregation, one Scotch and English Episcopalian, and one Roman Catholic. The Secession kirk had its origin in Stirling, through the deposition, A.D. 1738, of the Rev. Ebenezer Erskine, one of the three ministers of the parish.

There are some important charitable institutions. Gowane's Hospital, for poor members of the guildry and their families, has a clear yearly revenue of 2000*l.*; Spittal's Hospital, for the benefit of the seven incorporated trades or crafts, has a clear yearly revenue of 400*l.*; Allan's Charity, for maintaining, educating, and apprenticing poor boys belonging to the seven trades, of about 300*l.*; and Cunningham's Charity, for similar purposes, for boys belonging to the guildry, has a capital stock of nearly 6000*l.*

There were in 1834 three parochial schools (a grammar-school, an English school, and a writing-school), with five teachers, and from 106 to 109 scholars, chiefly boys; and eighteen other schools (some private; others, partly at least, supported by patronage), with twenty eight teachers, attended by about 455 boys and 376 girls.

St. Ninians consists principally of one long street of old-fashioned houses; some of these are very curious, and have not only the date of erection, but the utensils or other emblems of the trade of the original occupier carved on stones on the front. Several of the houses are whitewashed. There are a parish church and a meeting-house for dissenters of the Relief kirk. The steeple of the former parish church yet remains: the church itself was occupied by the Highlanders in the rebellion of 1745, as a powder-magazine, and was destroyed by an explosion, while the steeple remained uninjured. The inhabitants are engaged in the manufacture of nails and leather; and in the tartan and tartan shawl manufacture, of which Stirling is the centre. The parish of St. Ninians is large, and comprehends, besides the village of St. Ninians, the flourishing village of Bannockburn, comprising, with its colliery, a population of 2400; and several other villages and hamlets. Bannockburn has a considerable share in the tartan and carpet manufactures; and a good deal of business is done in tanning leather.

Grangemouth is in the parish of Falkirk, three miles north-east of the town of Falkirk. It is at the junction of the Forth and Clyde canal with the Carron, near the outfal of the Carron in the Forth. It takes its name from the Grange burn which formerly joined the Carron at this spot, but has lately been made to join the Forth, a mile eastward from the town, in order to convert its former channel into wet docks. The town of Grangemouth was commenced in 1777 by Sir Lawrence Dundas, in the well-founded hope that its connection with the canal would give it some consequence as a port. Having been built on a regular plan, the streets are well laid out and there are some neat good houses; from the flatness of the surrounding country and the adjacent sea-dykes and canal, the place has the appearance of a Dutch village. The town and neighbourhood have been constituted a parish *quoad sacra;* and a new church of Norman architecture has been built by the Earl of Zetland, the proprietor of the town. The Forth and Clyde canal terminates here in a basin and harbour, and two extensive wood-ponds. The basin and harbour afford facilities for large vessels to unload, and for the smaller ones to unload or to wait till they can proceed by the canal, the traffic on which is very great. Since April, 1838, great efforts have been made to improve the port; a wet-dock in the former channel of the Grange burn is in course of construction, with an immense sea lock, second in size to that of Bristol alone; the river Carron has been or is to be deepened; and one of the wood-ponds enlarged and made to communicate with the wet dock by means of a canal. The improvements are expected to be so forward by 1843, as to admit vessels into the wet-dock. There are private wharfs on the Carron.

Grangemouth has a custom-house; Alloa, Stirling, and Kincardine are included in the port. The imports are, grain, both coastwise and from the Baltic; timber from the Baltic, Norway, Canada, and New Brunswick; flax, hemp, tallow, pitch, tar, and manganese ore from the Baltic: cheese, bark, madder, and geneva from Holland and Belgium; and goods of all descriptions from London, Hull, Newcastle, Arbroath, Montrose, Dundee, and Aberdeen. The exports are, coals, pig and wrought iron, glass, bricks, cordage, linen yarn, and cotton and woollen goods. Steam and other vessels are built, and sail-cloth and rope manufactured.

The parochial schools are taught in a neat building in the cottage style, containing two good school-rooms, a library, and dwellings for the teachers, with a large playground. There are a female missionary society, an auxiliary Bible society, and a temperance society.

Kerse House, the seat of the Earl of Zetland, near Grangemouth, is in the Elizabethan style, and is in the midst of a finely wooded park.

Lauriestown is a mile and a half from Falkirk, on the Edinburgh road; the inhabitants are chiefly employed in nail-making, weaving, and agriculture. The village is regularly laid out, with a square in the centre. There are three schools and a Reformed Presbyterian meeting-house. Camelon is about a mile west of Falkirk, on the Glasgow turnpike road. It has a handsome new church and two schools, one built by subscription. The inhabitants are chiefly employed in nail-making. Both Lauriestown and Camelon are in Falkirk parish.

Campsie is a large parish in the southern part of the shire. The population in 1831 was 5109, and is now [illegible] tly 6000; it has increased nearly fourfold since 17[illegible] to the introduction of manufactures. The pri[illegible] is Lennoxtown, which contains nearly half of the population, Torrance has a population of about [illegible] and the[illegible]

are some other villages of tolerable size. There are three places of worship in the parish, namely, a large and handsome new parish church of Gothic architecture, a Relief meeting-house, and a Catholic chapel, all in Lennoxtown, where is also a handsome new school-house. The Catholic congregation consists of Irish, engaged in the cotton printing, the staple branch of industry in the parish. The most extensive print-work is the Lennox mill-field, which lately gave employment to nearly 700 persons of both sexes and of all ages. Kincaid field employed above 370; and Lillyburn field 150, and sometimes more, making a total of at least 1220. The are two bleach-fields which employed about 130 persons: and a work for manufacturing alum, prussiate of potash, prussian blue, &c., which employed 180 persons. There are several coal, ironstone, and lime works.

The state of education in the parish has been very low, but is improving. There are three parochial schools; a large school, not parochial, and an infant-school held in the new schoolhouse at Lennoxtown, built by subscription; and five or six small private schools. The number of children under instruction in day-schools is about 520, besides those in evening-schools and Sunday-schools, and those taught during work-hours in Lennox mill. There are two subscription libraries.

Kilsyth parish adjoins Campsie on the east. The population in 1831 was 4297, and has been nearly stationary since, except that it received a temporary augmentation from the persons employed in the construction of the Edinburgh and Glasgow railway. The village of Kilsyth is at the junction of the roads from Falkirk and Stirling to Glasgow. It is irregularly laid out, and the houses are small and mean-looking; the streets are lighted with gas. The parish church is a modern building of considerable elegance, but far too small for the population; a new church has been built in the village of Banton. There is a meeting-house for the Dissenters of the Relief kirk, and there is a small Methodist chapel, and a Mason lodge occupied as a place of worship by Independents. The inhabitants are chiefly hand-loom weavers employed by the manufacturers of Glasgow; two factories have been commenced lately. There are in the parish a small sickle manufactory, a paper-mill, and a brick and tile work. The Forth and Clyde Canal and the Edinburgh and Glasgow Railway pass near the village. Freestone, limestone, ironstone, and coal are dug in the parish. There is no weekly market, and the two yearly fairs are of no account. Kilsyth has a post office.

Kilsyth was erected, A.D. 1826, into a burgh of barony; it has a baillie and four councillors elected annually, who hold monthly courts for small debts and petty offences; all tenants and proprietors of houses of 5*l.* yearly rental are entitled to vote at the election.

There are three parochial schools, one in the immediate vicinity of the town; and there are two other schools; about 500 children are under daily instruction. There are a savings' bank, three benefit societies, several small libraries, and a temperance society.

Larbert is a parish adjacent to Falkirk parish, on the north-west. It contains the village of Carron, where is the most extensive iron foundry in Europe, about two miles north of Falkirk. There are five blast or smelting furnaces, four cupola furnaces, and twenty air furnaces; besides mills for grinding fire-clay, boring cylinders, grinding and polishing the metal, &c. Water and steam are the moving powers employed. The goods manufactured are machinery, agricultural instruments, and warlike implements, as cannon, carronades (which take their name from this place), mortars, shot, and shells. These works are carried on by a chartered company, the shareholders of which hold and work extensive coal, ironstone, and lime pits; and have about twenty vessels to export their goods to London and elsewhere, and bring back coal and lime. The Carron works employ about 2000 persons.

Denny parish is adjacent to Falkirk parish, on the west. The population in 1831 was 3843, and has since increased to about 4300. It contains four villages, Denny, Hags, Fankerton, and Loanhead, or Louchead. The village of Denny has the parish church with a turreted steeple at the west end 75 feet high, and a United Secession meeting-house. The houses are generally of modern erection, of two stories, with garrets, slated roofs, and sash windows. A neat school-house has been lately built. There is a church belonging to the establishment at Hags (to which a district has been attached as a *quoad sacra* parish), and a United Secession meeting-house at Loanhead. There are in the parish two mills for grinding charcoal for the moulders at the iron-works; two mills for paper and millboards, three mills for the manufacture of tartans, shawls, and linsey-woolsey; a dye-stuff-mill, a saw-mill, and three corn or oatmeal and pot-barley mills; also two distilleries, a brick-work, two calico-print works, a pyroligneous acid manufactory, and a spade manufactory. Most of the mills are on the Carron. Ironstone, freestone, and whinstone are dug, and there is one coal-pit at work. About 1100 persons in the parish and about 200 in adjacent parishes are (or were lately) employed directly or indirectly by the manufactories and mills; 1000 of these are connected with the calico print-works; besides the manufacturing population, about 90 persons are employed in the coal-pit. There are ten schools, one of them parochial, another a dame's school; a parochial library, a religious library, a congregational library at Loanhead, and several benefit, Bible, mutual instruction, and other societies. Denny has a post-office and two yearly fairs. The Forth and Clyde canal, and the Edinburgh and Glasgow railway, pass not far from Denny.

Balfron parish is in the western part of the county; the population in 1831 was 2057, of whom about 1700 were in the village of Balfron, which is in the western part of the parish, 19 miles from Glasgow, and as many from Stirling. The census of 1841 makes the population of the parish 1968. The village is neatly built and clean, and the shops are lighted with gas from the adjacent cotton-works of Ballindalloch, which lately employed about 260 persons, chiefly women and girls. There are many hand-loom weavers: from 300 to 400 looms were lately at work, making light jaconots and lawns. The parish church is a plain building rebuilt in 1832-3; and there are three dissenting places of worship in the parish. There are four schools, one of them parochial, another partly supported by subscription, and having a school-house and master's residence built by subscription, a third in connexion with the cotton-works, by the owners of which it is mainly supported, and the fourth a private school. There is a subscription library.

Kilpatrick parish, sometimes distinguished as East or New Kilpatrick, is at the southern extremity of the county, and is partly in Dumbartonshire: the population in 1831 was 3090; of whom about 1250 were in the manufacturing village of Milngavie. In the parish, and most of them in the village, are a cotton-mill, two bleachfields, three printfields, a distillery, a paper-mill, a snuff-mill, and several corn-mills, giving employment altogether to 900 persons. There is a meeting-house for dissenters of the Relief kirk in the village; the parish church is two miles distant, in Dumbartonshire. There are a parish-school and five private schools, with about 300 scholars; five Sunday-schools, with about 190 scholars; and a respectable subscription library.

The parish of Alva forms a detached part of the county; the village of Alva is on the river Devon, between Stirling and Kinross. The woollen manufacture has long been established in the parish; the earliest article made appears to have been serge; this was succeeded by plaidings and blankets; at present tartan shawls, blankets, and plaidings, and chequered Kerseymeres are the chief articles: about 500 or 600 men, women, and children are employed in this manufacture. The parish school-house, a good building, is in the village; the parish church, on an eminence a little to the east of the village. Besides the parish school, there are a subscription school; and an infant-school and a girls' school, supported by the principal family in the parish.

Fintry is the most central parish in the shire; its population in 1831 was 1051; above 600 of whom are in the village of Fintry, which has arisen from the establishment of a cotton-mill, which contains 20,000 spindles, and employs about 260 persons. There are also a distillery and a small wool-factory. The village consists of a row of houses regularly built, with two stories and a garret, ranged on one side of the road, with their gardens on the other side. There are a parish school and an endowed school, the latter chiefly for the children of those who work in the mill, with a good school-room and house for the teacher: this school has 100 day scholars, and 50 to 60 evening scholars. There are also a Sunday-school and a subscription library. The parish church is a plain neat building, nearly a mile from the village.

In Strathblane parish, on the south-west side of the county, are a calico print-work and two bleachfields, which

give employment to above 200 persons. There are one parochial and two private schools; a young men's society, combining the double object of a religious meeting and a mechanics' institute; a parish library; a savings'-bank; and Bible, missionary, and temperance societies.

Menstrie, with a population of 500, has a woollen-manufactory and a distillery; and the pretty village of Bridge of Allan, with a population of 200, is resorted to for the sake of the adjacent mineral springs of Airthrey. Both are in Logie parish, which is on the north side of the Forth near Stirling.

Divisions for Ecclesiastical and Legal Purposes.—The twenty-six parishes wholly or partly in the shire are arranged as follows:—

Parish.	Presbytery.	Synod.
Baldernock	Dumbarton	Glasgow and Ayr
Balfron	"	"
Buchanan	"	"
Drymen	"	"
Fintry	"	"
Killearn	"	"
Kilpatrick, E. or New	"	"
Strathblane	"	"
Campsie	Glasgow	"
Kilsyth	"	"
Kippen	Dunblane	Perth and Stirling
Lecropt	"	"
Logie	"	"
Airth	Stirling	"
Alva	"	"
Bothkennar	"	"
Denny	"	"
Gargunnock	"	"
Larbert, with Dunipace	"	"
Ninians, St.	"	"
Stirling	"	"
Falkirk	Linlithgow	Lothian and Tweeddale
Muiravonside	"	"
Polmont	"	"
Slamannan	"	"

Larbert and Dunipace are for ecclesiastical purposes united. There are several *quoad sacra* parishes which have been formed by the subdivision of the above. The Seceding churches of the associate synod are chiefly in the presbyteries of Glasgow, and of Stirling and Falkirk; those of the Relief kirk in the presbyteries of Glasgow and St. Ninians; and those of the Reformed Presbyterians in the presbyteries of Edinburgh and Glasgow.

While the Scottish church was episcopal, the parishes in the eastern part of the county were in the diocese of St. Andrews; and those in the western and southern parts in that of Glasgow; Kippen was in the diocese of Dunkeld, and Alva in that of Dunblane. On the erection of the diocese of Edinburgh by Charles I., A.D. 1633, all the parishes in the diocese of St. Andrews, except Logie and Lecropt, were subtracted, and placed under the jurisdiction of the newly created bishop. The Rev. Ebenezer Erskine, one of the leaders of the great secession, and founders of dissent in Scotland, was minister of Stirling, and was deposed from his charge by the General Assembly in 1738. His influence led to the secession of a great number of persons in this shire.

The circuit court of justiciary, and the general quarter-sessions for the county, are held at Stirling. Ordinary and small debt sheriff-courts are held weekly at Stirling and at Falkirk: there is a sheriff-substitute at each place. Sheriffs' small-debt circuit-courts are held quarterly at Drymen, at Lennoxtown of Campsie, and at Balfron. There is a county and burgh prison at Stirling for debtors and criminals, but in the Inspectors of Prisons' Fourth Report (*Parl. Papers* for 1839, vol. xxii.) it is described as being one of the worst in Scotland: the discipline and general management were altogether very bad, and the keeper quite unfit for his place. The average number of criminal prisoners in the year ending 1st October, 1838, was about 26 males and 7 females: of debtors about 3, almost entirely males: the average number for the year ending Michaelmas, 1839, was from 42 to 43 criminals (27 males, and 15 to 16 females), and from 3 to 4 debtors, all males. There is a small burgh gaol at Falkirk, in which there were, on an average of the year 1838-9, 4 criminals, chiefly men. There are small lock-up houses at Alva and Kilsyth. Falkirk and Kilsyth are altogether unfit. The police of the county is altogether insufficient.

The county returns one member to parliament: the number of electors registered in 1835-6 was 2092; viz. 863 sole or joint proprietors, 22 life renters, 1025 leaseholders, or tenants paying a gross sum of 300*l*, 36 husbands voting on their wives' qualification, 35 voters by virtue of office, 7 with joint qualification, and 104 transferred from the old roll of freeholders: in 1839-40 the total number of voters was 2323, viz. 993 proprietors, 127 life renters, 1022 leaseholders, &c., 40 husbands, 38 officers, 5 with joint qualification, and 88 freeholders from the old roll; showing an increase in four years of 231 voters. The detached parish of Alva is, for parliamentary purposes, attached to the county of Clackmannan, but for judicial purposes remains attached to Stirlingshire.

Stirling returns a member in conjunction with Culross, Dunfermline, Inverkeithing, and Queensferry. The number of voters at Stirling was, in 1835-6, 497; in 1839-40, 471, showing a decrease of 26. For the whole district the number was, in 1835-6, 1220; in 1839-40, 1141; showing a decrease of 79. Falkirk returns a member in conjunction with Airdrie, Hamilton, Lanark, and Linlithgow. The number of voters at Falkirk was, in 1835-6, 318; in 1839-40, 387; showing an increase of 69. For the whole district of burghs, the number was, in 1835-6, 1083; in 1839-40, 1369; showing an increase of 286. The writs for the two districts are proclaimed at Stirling and Falkirk respectively.

Education and Crime.—By the Returns made in 1834, and presented to Parliament in 1837 (*Parl. Papers* for that year, vol. xlvii.), the number of parochial schools was thirty-three, with 39 teachers, and a number of scholars varying from 1331 to 1857, nearly two-thirds of whom were boys: the number of other schools was one hundred and twenty-one, with 138 teachers, and a number of scholars varying from 3552 to 5211, about three-fifths of whom were boys; making a total of one hundred and fifty-four schools, with 177 teachers, and from 4883 to 6969 scholars. By making an allowance for defective returns, the estimated number of scholars is supposed to be from 6670 to 8825. The number of children between the ages of five and fifteen who have learned or are now learning to write, as specified in the returns, is 2467, but the estimated number, making due allowance for defective returns, is supposed to be 4959: the number who have learned or are learning to read is by the returns 4223; but after allowing for defective returns, is supposed to be 8489, which is probably not half the whole number of children in the shire. The above returns relate to day-schools alone, not to Sunday-schools.

The state of education in the manufacturing parish of Kilsyth is declared by the inspector of prisons to be unsatisfactory. (*Second Report, Parl. Pap. for* 1837, vol. xxxii.) 'Many parents altogether neglect the instruction of their children. . . . . It is estimated that about two-thirds of the adult population are able to read easily. The people are not however much given to reading.' There is a great deal of drunkenness, and many offences are committed, chiefly assaults and petty thefts, which escape detection and punishment, the police being inefficient. Crime had indeed increased, but not in a greater proportion than population, and the offences were of a less heinous character. (*Report*, as above.)

There appear to be many offences of rather a petty kind in this county, though not many that are very serious. The most common are assaults and thefts. Falkirk, Alva, and Lennoxtown of Campsie, with their respective neighbourhoods, are the places in which offences are most frequent. The offences at Falkirk are chiefly assaults and petty thefts; but the assaults appear to be decreasing: they occur chiefly at Carron (the most notorious place for offences in the east side of the shire), and are usually occasioned by drunkenness. Grangemouth, on the other hand, is one of the most quiet and orderly places in the district. The highland parish of Buchanan, the parishes of Drymen and Killearn in the western part of the shire, Baldernock in the south, and Bothkennar and Slamannan in the east, are stated to be particularly free from crime and disorder.

There is a good deal of crime at Stirling, where there is, for the size of the place, a considerable disorderly population, consisting of prostitutes, thieves, and other loose characters; and there are always a number of vagrants in the town, by whom half the crimes and disturbances are com

mitted. (*Inspectors of Prisons' Second, Third, and Fourth Reports.*)

History, Antiquities, &c.—Stirlingshire was, at the most antient historical period, included in the territory of the Δαμνόνιοι (Damnonii), a nation mentioned by Ptolemy and by Richard of Cirencester, who calls them Damnii. They were subdued by Agricola, A.D. 80, who formed a line of forts through their territory, reaching across the island from the Bodotria Æstuarium, or Frith of Forth, to the Glotta or Clyde: this line of forts, the Roman general Lollius Urbicus, in the reign of Antoninus Pius, about A.D. 140, connected by a continuous rampart of earth or turf. Whether all the forts which may be traced, or which with good reason are supposed to have existed along the line of the rampart, were built by Agricola, or whether the number was increased by Urbicus and his successors, cannot now be determined. The forts, like the connecting rampart, were originally of earth, but appear to have been, at a subsequent period, faced with stone.

The rampart of Urbicus, or, as it is sometimes called from the emperor in whose reign it was constructed, 'the rampart of Antoninus' (Antonini Vallum), commenced on the shore of the Frith of Forth, a little to the east of Borrowstowness in Linlithgowshire, and ran westward through Linlithgow, Stirling, Lanark, and Dumbarton shires, to the Clyde at West or Old Kilpatrick. It consisted of a comparatively slight rampart, with a deep ditch on the north side, and a military road accompanying it on the south side: the remains of it are popularly known as Graham's, Græme's, or Grime's Dyke, a name the origin of which is not ascertained. It entered Stirlingshire in the parish of Polmont, about three miles east of Falkirk, and ran west-south-west through Polmont and Falkirk parishes, into a detached part of Dumbartonshire. In the parish of Polmont all traces of the work have disappeared, but in Falkirk there are some traces of the ditch, which are particularly observable in Callendar park and Lauriestown, just to the east of Falkirk town. The remains of one of the forts may be seen at Castle Cary, six miles west of Falkirk, just where the rampart leaves the shire. It is a square fort, with an area of six acres, the rampart of Urbicus forming its northern side; the military way passed through it from east to west, and another military road entered it from the south. Several antiquities have been dug up in the ruins of a house in the south-east angle of this fort; and from the number of human bones found in the building, and from a great quantity of burnt wheat, it is supposed that the garrison must have been slaughtered, and the place burnt by the natives. It is supposed to have been the Κόρια (Coria) of Ptolemy. Another fort, about three miles and a half to the east of Castle-Cary, is described by Roy (*Military Antiquities of the Romans in Britain*), and Nimmo (*Hist. of Stirlingshire*); but all traces of it have now disappeared, except a slight elevation of the ground marking its site: it was called Rough Castle.

At Camelon near Falkirk, about three-quarters of a mile to the northward of the rampart of Urbicus, were to be seen, some years since, the remains of a Roman station. They were on a Roman road, which led from the rampart to the Forth, which it crossed above Stirling, and thence to the Roman posts in Perthshire. Roy describes the station at Camelon as being, from its extent, and the many vestiges of buildings remaining in it, one of the most considerable which the Romans had in North Britain. It consisted of two parts, the southern part appearing to have been the original station, and the northern part a subsequent addition. All traces of it have now disappeared. The Alauna of Richard of Cirencester is supposed to have been at Kier, in Leckropt parish, between the rivers Teith and Allan, north of the Forth, not far from Stirling: but there do not appear to have been any traces of works observed. The names Alauna and Allan probably embody the same element. The Roman road just mentioned probably ran from Camelon by Alauna or Kier to Lindum (Ardoch), Victoria, and other posts in Perthshire. Some parts of this road may yet be observed near Camelon. It was formerly, and perhaps is still, called Camelon causeway. It is a very carefully-made road, consisting of several layers of stones and earth, filling a trench made for it, and rising above the level of the ground, so as to form a raised causeway, with a small ditch or drain on each side.

A singular building on the banks of the Carron, near where the iron-works are now, supposed to have been a sacellum or chapel, was demolished about a century since. It was a circular stone building, of nearly 20 feet diameter inside, with the walls rising perpendicularly at first, and gradually closing inward so as to form a dome, with a large circular opening at the top 11 feet 8 inches in diameter.

There are some other antiquities referrible perhaps to the Roman period, or to the periods immediately before or after it. There are a few of the stone monuments commonly regarded as Druidical, earthen forts, cairns, and mounds or barrows, in Baldernock, Muiravonside, Gargunnock, Dunipace, Logie, and other parishes. Of the condition of the shire in the ages succeeding the Roman dominion we have no account. It was probably debateable ground, lying near the frontier of four kingdoms, having the Anglo-Saxon kingdom of Northumbria on the south-east, the British kingdom of Strath-Clyde on the south-west and west, the Scottish on the north-west, and the Pictish kingdom on the north and north-east. It is stated by Nimmo, but we believe on very questionable authority, that a severe battle was fought near Stirling, between the Scots, under their king Kenneth II. (Mac Alpin), and the Picts, in the course of that revolution which united the Scottish and Pictish kingdoms under one sceptre. Nimmo (*Hist. of Stirlingshire*) is disposed to trace the name Cambuskenneth, near Stirling, to this battle, and to regard some large stones (supposed by others to be Druidical) near the church of Logie, two miles north of Stirling, as memorials of it.

As the united kingdom of the Scots and Picts was extended by the addition of the territories of the Strath-Clyde and Cumbrian Britons, and of the northern part of the Anglo Saxon kingdom of Northumberland, Stirling became an important town, from its central situation, its strong fortress, and its commanding the passage over the Forth. It early become a royal burgh, sharing the honour with Edinburgh, Berwick, and Roxburgh. Its earliest known charter is of Alexander I., A.D. 1119, but this is simply confirmatory of one conferred previously.

Cambuskenneth abbey, one of the most eminent in Scotland, was founded, A.D. 1147, by David I., king of Scotland, for regular canons of St. Augustin, on a small peninsula on the north side of the Forth, a little below Stirling. Of this edifice some ruined walls and the belfry tower still exist. It was not unfrequently called Striveling or Stirling Abbey, from its neighbourhood to that town.

Other religious houses in the shire were founded by succeeding monarchs.

In the invasion of Edward I. Stirling was abandoned by the Scots and occupied by the English (A.D. 1296). In the rising under Wallace, that chieftain, having made considerable progress in Forfarshire, advanced to Cambuskenneth on the Forth with about 40,000 men, to oppose the English army, which was advancing to Stirling, under the orders of the earl of Warenne and Surrey, guardian of Scotland, and of Hugh Cressingham, an ecclesiastic, whom Edward had made treasurer of Scotland. At the bridge of Stirling, at that time a wooden structure, half a mile above the present 'old' bridge, the English, who numbered above 50,000, were, through the weakness of Surrey and the presumption of Cressingham, utterly routed (11th September, A.D. 1297), and the whole of Scotland was recovered by the blow. Next year (A.D. 1298) Edward in person entered Scotland with an immense army of 80,000 infantry and 7000 cavalry, besides a body of Gascons, and at Falkirk routed Wallace, who could muster only a third part of the enemy's numbers, and whose inferior force was further weakened by the disunion or treachery of its chiefs. The Scots lost 15,000 men; the remains of their army retreated to Stirling, but unable to hold the town, they reduced it to ashes: Wallace resigned his office as guardian of the realm; but Scotland was not immediately subdued. Stirling castle, which was garrisoned by the English, was besieged by the Scots, under the regents, Comyn of Badenoch and John de Soulis, and forced by famine to surrender (A.D. 1299). When in A.D. 1303 Edward overran Scotland, Stirling castle held out against him, and Comyn broke down the bridge, and with all the force he could muster encamped on the ground which Wallace had occupied before his great victory. Edward however passed the river by a ford, and dispersing Comyn's force, quashed for the time all resistance, except in Stirling castle, in which a handful of brave men held out for three months against all the efforts of the king in person, and which was the last fortress that surrendered in Scotland.

In the reign of Robert Bruce, who had recovered Scotland from the English, the great battle of Bannockburn was

fought in this shire (A.D. 1314). Bannock-burn is a small rivulet flowing eastward, south of Stirling, and falling into the Forth below that town, and has given name to a flourishing manufacturing village on or near it. Stirling castle, which appears to have been held by the English ever since its last capture by Edward I. (A.D. 1303), had been besieged by Bruce, and was to surrender if not relieved by midsummer. It was to the relief of this fortress that the English host of 100,000 men were advancing. Bruce, with 40,000 men, encamped between Stirling and Bannockburn, and here awaited the attack, which ended in the utter defeat of the English. Stirling castle surrendered, and Scotland was delivered from impending ruin. This was the third time, in seventeen years, that the fate of that country had depended on a battle fought in this shire; twice, at Stirling and at Bannockburn, it had been delivered by the conflict, and once, at Falkirk, had fallen under the power of its enemies.

In A.D. 1333 Stirling castle, with the rest of Scotland, came into the hands of Edward Baliol and his English allies. It was retaken (A.D. 1341) by the Scots after a long and gallant defence. The garrison were compelled to surrender by famine.

In the reign of James II. Stirling castle was the scene of the assassination of the earl of Douglas (A.D. 1451). The troubles of the reign of James III were brought to a close in this shire by the battle of Sauchie burn, a small rivulet midway between Falkirk and Stirling. (A.D. 1488.) The insurgent lords, with the king's son (afterwards James IV.) at their head, gained the victory over the royal army, and James, thrown from his horse in the flight, was murdered in a cottage to which he had been carried.

Stirling castle was the frequent residence of James V., and from it he frequently issued on those excursions in which he mingled in disguise among his subjects. Sir W. Scott's 'Lady of the Lake' details a supposed adventure of the king in one of these excursions.

James VI. was crowned at Stirling (A.D. 1567) at thirteen months old; and during his childhood, usually resided here with his preceptor Buchanan, who wrote here his 'History of Scotland.' In the troubled period of his minority, while the Scottish parliament were assembled at Stirling (A.D. 1571), the leaders of it were surprised and captured by a party of 400 men, sent from Edinburgh castle by Kirkaldy of Grange, who held out in that fortress for Queen Mary. The surprising party were however defeated, and the prisoners rescued by the earl of Mar, who sallied from the castle. The earl of Lennox, the regent for the king, was mortally wounded in the fray.

The earls of Angus and Mar, with others of those concerned in 'the raid of Ruthven,' took possession of Stirling town and castle (A.D. 1584), but were soon obliged to quit the place and flee into England. Returning next year with a considerable force, they occupied the town, and prepared to invest the castle, where the king (James VI.) was with a very inadequate force. An accommodation took place, and the judicial sentence which had been passed against the fugitive lords was reversed. This transaction is commonly called 'the raid of Stirling.'

Prince Henry, eldest son of James VI., was born at Stirling (A.D. 1594), and his baptism was performed in the castle with great state.

On occasion of the disturbances which arose at Edinburgh on the introduction of the New Liturgy in the reign of Charles I., A.D. 1637, the privy council and the court of session removed to Stirling, to which town none were allowed to repair without a warrant from the privy council; but on the very evening on which proclamation to this effect was made, and another proclamation read appointing the use of the Liturgy, a body of 2000 armed men entered the town, from whence they marched next day to Edinburgh to consult about further proceedings.

The last victory gained by Montrose in his brilliant campaign of 1644-5 was in this county. General Baillie, an officer of experience, who nominally commanded the Covenanters, was compelled by 'the Committee' which had been appointed to direct and control him, to attack Montrose, who, with the Royalist army, was at Kilsyth. Baillie had 6000 infantry and 1000 cavalry, while the Royalists had only 4400 foot and 500 horse; but notwithstanding his superior numbers, he was utterly routed, and nearly all his infantry killed or taken. He fled with such of his cavalry as he could collect to Stirling.

After the failure of the Scots' expedition into England in favour of Charles I., under the duke of Hamilton (A.D. 1648), those who had opposed that expedition rose in arms and a body of Highlanders of the insurgent party, under the marquis of Argyle, was surprised at Stirling and cut in pieces or captured; the rest of the party, under the earls of Eglintoun and Loudon, were posted at Falkirk, and with them an accommodation was entered into, which brought the affair to an amicable issue. The Scotch army retired to Stirling after their defeat by Cromwell at Dunbar, A.D. 1650; and again occupied the town and encamped at Torwood, about six miles south of it, previous to their ill fated march to Worcester (A.D. 1651). Cromwell was encamped at Linlithgow, and vainly attempted to draw the Royalists, who were commanded by Charles II. in person, to a battle. He stormed Callender House, close to Falkirk, in their sight; and having obliged them to retreat from Torwood to Stirling, captured many of their sick and a considerable quantity of military stores. Charles having marched into England and been followed by Cromwell, Monk, whom the latter had left behind him, occupied the town of Stirling, and in a few days forced the castle to surrender. The castle, and the steeple of the church, near which the besiegers had planted their batteries, bear still the marks of the damage sustained during this siege.

In the rebellion of 1715 the Royalists, under the duke of Argyle, marched from Stirling to encounter the rebels under the earl of Mar, at Sheriff Muir near Dunblane. [PERTHSHIRE.] The highland district of Stirlingshire was about this period the resort of the celebrated Rob Roy. In the rebellion of 1745 6 General Cope took post at Stirling previous to his march into the north of Scotland; but the Young Pretender eluded him, crossed the Forth below Stirling, and marched to Edinburgh. On the retreat of the rebels from England they besieged Stirling castle (12th of January, 1746), and General Hawley, at the head of a considerable force, having advanced to relieve it, was defeated by them (17th of January) at Falkirk. The Royalists numbered about 6000 men, the insurgents rather more. The loss of men was not great, but some pieces of cannon were taken, and the whole affair was discreditable both to Hawley and his troops. The siege of Stirling castle was resumed after the engagement, but finally abandoned on the approach of the royal army under the duke of Cumberland; the rebels in their retreat blew up their powder magazine and abandoned their cannon and a number of their sick and wounded.

During the political excitement of the year 1820 some skirmishing took place at Bonny Muir, near Falkirk, between the Radicals and the military, who were sent to repress the disturbances. The Radicals, who were armed, were chiefly from Glasgow.

The principal antiquities, besides Stirling Castle and Cambuskenneth Abbey, are the remains of some old castles and towers There is the keep of an old castle near the Roman fort of Castle Cary, on the line of Urbicus' rampart. Duntreath Castle, in Strathblane parish, is a tolerable extensive ruin. The remains of Colzium Castle crown an eminence near Kilsyth; and the castle of Almond is a massive ruin between Falkirk and Linlithgow. The ruins of Manuel Priory are near the castle of Almond.

(*New Statistical Account of Scotland*; Nimmo's *History of Stirlingshire*; Tytler's *History of Scotland*; *Parliamentary Papers*, &c.)

STIVER. [MONEY.]

STIZOLO'BIUM, a genus of plants which was so named by Persoon, from *stizo*, 'to prick,' and *lobos*, 'a pod,' from the pods of the several species being covered with hispid hairs. The species have now been removed chiefly to Pachyrhizus [DOLICHOS] and to Mucuna: of the latter of these Stizolobium now forms a subgenus. The principle species of Mucuna have already been mentioned under the article COWITCH, or COWAGE, which is no doubt a corruption of the Hindostanee name *kiwach*, which is the *Mucuna prurita* of Hooker, indigenous in various parts of India, but usually confounded with *Mucuna pruriens*, a native of the West India Islands. The Indian M. prurita is distinguished by its smaller leaves, its more obtuse leaflets, the middle one being more truly rhomboidal, its flowers more constantly in threes, and by its legumes being much broader, compressed, and free from any raised line on the back of the valves, whilst in the American M. pruriens the pods are narrower, terete, and keeled on the valves. Another valuable but

little known species is *Mucuna utilis*, the *pois noire* of the islands of Mauritius and Bourbon, and thought to be a native of Arabia. It is universally employed in the above islands for enriching the soil for the cultivation of sugar. The thick covering of herbage with which the soil becomes covered, must be useful in preventing the soil from becoming parched, while the whole crop, being afterwards ploughed in, is found to be eminently useful in enriching the soil. The seed has been introduced into India and is spreading over the country.

STJERNSTOLPE, JONAS MAGNUS, was born December 8, 1777, in the parish of Stenquist, in the province of Södermanland, in Sweden, of respectable parents, but who were so poor that they could afford to give him only the most ordinary education. In all probability therefore his talents would have remained in obscurity, had not his unusual abilities attracted the notice of Baron Fletwood and one of his friends, who put him to school at Strengnäs, where he soon distinguished himself, and whence he was afterwards sent to finish his studies at Upsala. He seems however to have been very scantily provided for, since in order to eke out his means of support he was obliged to give lessons and employ himself in translating novels for booksellers. At length an event occurred in 1802 which he himself has described as a most propitious revolution of fortune, namely, his being taken into the family of M. Beskow, a merchant, as tutor to his two sons, one of whom (Bernhard) has since distinguished himself as a poet, and has edited some of Stjernstolpe's posthumous pieces, with an interesting biography of their author. From this event however no permanent advantage to his circumstances seems to have resulted, for notwithstanding his attachment to his studies, he determined to renounce his prospects in any of the learned professions, and to accept a small appointment in a public office (the Krigs-Expedition), devoting only his leisure time to literary occupations. These consisted at first merely of translations of Muller's 'Siegfried' and other German romances, to the extent of about 30 volumes. It was then that Beskow, wishing to assist him, offered him a situation in his own counting-house, with a salary more than double of what he then had; but he rejected the well-meant proposal, saying, that he preferred drinking water and writing verses to drinking wine and casting up accounts. Though he himself might not consider the labour of translating drudgery, that kind of it in which he first engaged was certainly unworthy of his talents. Therefore although it is to be regretted that he did not undertake some original work of similar extent, it was not without advantage to the literature of his own country that he afterwards transplanted into it some of the productions of such writers as Cervantes, Wieland, and Voltaire. Besides 'Don Quixote,' 'Oberon,' and some of the tales of Voltaire, his translations of this class include those of Pope's 'Rape of the Lock,' and Blumauer's 'Æneis' (which latter poem he completed by adding the three last books, and which is considered to be in many respects even superior to the original); not to mention a number of minor pieces, both from antient and modern poets. Among his original productions, which are comparatively few, the principal are, 'Lunkentus,' a dramatic popular tradition; the 'Argonauts;' and his comic tales in verse.

Notwithstanding his decided taste for works of fancy and humour, satire and wit, his reading extended to others of a very different class, to mathematics and the physical sciences, geology and astronomy, to which last study he was greatly attached. According to his biographer Beskow, the same remarkable sort of contrast displayed itself in his conversation, for he would pass alternately from the gayest and liveliest topics to the most serious, from the most playful to the most profound. His conversational powers were, in fact, of the highest order: it was there that the originality of his mind fully displayed itself, for he possessed such extraordinary *improvisatore* talents, that he would delight his auditors almost an entire evening by a continual flow of wit and eloquence, which carried away both himself and his hearers. These captivating qualities and the amiableness of his personal character, his frankness and his disinterestedness, caused his society to be greatly sought after by all who were distinguished in literature and art; whence it was said of him that he was not only known to all Sweden, but intimate with one half of it. He constantly refused however to become a member of any literary society for which institutions he entertained no great respect. His epistolary correspondence was very extensive, and was marked by the same qualities as his conversation, though hitherto but a few specimens of it have been published by his biographer. He had commenced a translation of Ariosto, but did not live to make any great progress with it, being carried off by a paralytic attack on the 17th of September, 1831. (Beskow, *Minnesteckning*.)

STOAT. [WEASELS.]

STOBAE'US, JOANNES, a native of Stobi in Macedonia, whence he derives his name Stobaeus, lived either at the end of the fifth or in the sixth century of our æra. Respecting his life no particulars are known. We possess through him a number of extracts from antient Greek writers. He collected them in the course of his extensive reading from more than five hundred authors, both in prose and in verse, and put them together, and arranged them according to subjects for the use and instruction of his son Septimius. We are thus indebted to Stobaeus not only for an immense number of fragments of well known antient writers, but some authors would be altogether unknown to us if Stobaeus had not preserved their names, together with some of their sentiments. The words of Greek poets are of course quoted verbatim, but in regard to prose writers he followed two different methods; sometimes he quotes the author's own words, and gives us real extracts, and sometimes he gives a mere summary or epitome of what his author contained. He himself called this anthology from Greek literature, Ἀνθολόγιον ἐκλογῶν, ἀποφθεγμάτων, ὑποθηκῶν, and divided it into four books. But the work has come down to us in a somewhat different form. In our MSS. it is divided into three books, which form two separate works. The first and second books are usually called Ἐκλογαὶ φυσικαί, διαλεκτικαί, καὶ ἠθικαί, and the third Ἀνθολόγιον, or Sermones. It has therefore been supposed that one book of Stobaeus is lost, but it is more probable that the 'Sermones' contain the third and fourth books in one, according to the original division. It is true that the third book at present consists of 127 or 128 chapters, while in the time of Photius the two last books together only contained 100 chapters. This difference in number however may be accounted for by supposing that some of the larger chapters were divided by copyists into two or more smaller ones.

The editio princeps of the 'Eclogae' is that by W. Canter, Antwerp, 1575, fol., with a Latin translation. It was reprinted, together with the 'Sermones' (the first edition of which was edited by Trincavelli, at Venice, 1536, in 4to.), at Geneva, 1609, in fol. C. Gesner published three editions of the 'Sermones.' under the title 'J. Stobaei Sententiæ,' Tigur., 1543; Basil., 1549, and Tigur., 1559, with many arbitrary alterations. The best modern edition of the 'Eclogæ' is that by A. H. L. Heeren, with notes and a Latin translation, Göttingen, 1792-1801, 2 vols. 8vo.; and the best edition of the 'Sermones' is that by T. Gaisford, Oxford, 1822, 4 vols. 8vo., reprinted at Leipzig, 1823 and 1824, in 4 vols. 8vo. A complete edition of both works of Stobaeus has been published by Tauchnitz, at Leipzig, 1838, in 3 vols. 16mo. (Schöll, *Geschichte der Griech. Lit.*, iii., p. 395-414.)

STOCK, the English name for the genus of plants named by Brown *Matthiola*. [MATHIOLA.] Many of the species of this genus are great favourites in gardens, on account of their handsome flowers and fragrant smell. In order to raise the more valued kinds, as the double-stock gilliflower, the Brompton and queen's stocks, the seed should be saved from plants growing among double flowers, as it has been proved that such seed produce more plants with double flowers than the seed obtained from plants bearing double flowers. The seed should be sown in May, and when the young plants have attained a height of two or three inches, they should be thinned out till they are about nine inches asunder. The plants that are taken out may be planted in the flower-border, at about six inches distance from each other. If the following winter should be severe, they should be covered over with mats. In the following spring they will produce their flowers. The annual or ten-week stock (*Matthiola annua*) may be sown three or four times in the season: in February, March, April, and May; those that are sown in the last month will blossom till Christmas. All the annual sorts may be treated in this way. The double varieties of the shrubby kind may be propagated by cuttings, under a hand-glass, and placed in a shady place. A soil that is light and mixed with sand is the best adapted for them. The stock will not bear transplanting at a late period of its growth, as its fusiform root is not

supplied with lateral radicles, and the spongioles at the end of the root are almost sure to be destroyed when this operation is deferred beyond a few weeks.

STOCKBRIDGE. [HAMPSHIRE.]

STO'CKHOLM, the capital of Sweden, is situated in 59° 20′ N. lat. and 18° E. long., on the channel by which the lake Mälarn discharges its waters into the Baltic. Following the numerous windings of this channel, the open sea is reached at a distance of 36 miles from the town, but in a straight line the distance does not exceed 24 miles. The channel varies in width between less than a mile and five miles, and is interspersed with numerous rocky islands.

The city of Stockholm is built partly on the continent and partly on nine islands formed by the above-mentioned channel: the islands are called *holmen*. In the middle of the channel are the islands of Stockholmen, also called Staden, because the town was originally first built on it, and Riddar Holmen (the island of the knights). South of them is the large island of Söder Malm, at the western extremity of which are Lang Holmen and Räkning Holmen. North of the channel a large portion of the town is built on the continent, and called North Malm. With this part is united the island of Kongs Holmen (King's Island), which lies west of it, and those of Blasii Holm, Skepps Holmen (Island of Vessels), and Kastell Holmen, which are east of North Malm.

The Staden, or Stockholm, occupies the centre of the town, and contains several fine public and private buildings. The royal palace, an edifice of great architectural merit, stands on an eminence, and is surrounded by a large garden. Besides the apartments in which the royal family reside, it contains a library, collections of paintings, coins, and antiquities. Before the extensive court-yard of the palace, and near the banks of the channel, is the colossal statue of Gustavus III, of bronze: and in its vicinity, along the eastern shore of the island, is the proper harbour of the town, in which the largest vessels find excellent anchorage. Along it there are large storehouses for foreign goods. Farther to the west is the cathedral, or St. Nicolai Church, also called 'storkyrka,' or head church, in which the kings of Sweden are now crowned: and at some distance from it, on the Riddarhustorg (or Square of the Hall of the Knights), is the statue of Gustavus Vasa, of bronze. From the square a stone bridge leads to the Riddarholmen, which is much smaller than Stockholmen, but which contains several large public buildings, among which are the old palace and the old church of Riddarholmen, in which the kings and distinguished persons born in Sweden are buried, and about five thousand flags are hung up, the trophies of the Swedes in their numerous wars. The legislative body also holds its meetings here.

Söder Malm, or the southern division of Stockholm, is built on the island of the same name, which is about three miles long and nearly two miles across in the widest part: it is joined to Stockholmen by a long bridge of boats, and provided with a large lock on account of the great rapidity with which Lake Mälarn sometimes discharges its waters. The surface of the island is rocky and very broken; and though there are also many fine buildings near the channel, the interior of this section of the town is mostly composed of small wooden houses situated between rocks and swamps, and of gardens and corn-fields. In the Söder Malm is the great depôt of iron, whence it is shipped to all quarters of the globe. The most remarkable of the buildings are the town-hall, the Danviken or Great Hospital, and the Maria Magdalene and the St. Catharine Church. The island of Lang Holmen, which is farther west, and is united to the Söder Malm by a bridge, contains the houses of correction; and on Räkning Holmen, which likewise is joined to Söder Malm by a bridge, there is a park.

The Norr Malm, or northern division of the town, is on a gentle slope, which gradually rises about 200 feet above the sea-level. It is much better built than the Söder Malm, and has several fine squares and streets, among which King's Street is distinguished by many good buildings. A well-built bridge connects it with Stockholmen. On the finest of the squares, called that of Gustavus Adolphus, is the bronze equestrian statue of that great king. One of the sides of the square is occupied by the opera-house, a fine large edifice. Not far from the square is the king's garden (Kungs Tregorden), a fine piece of ground, planted with trees and used as a public promenade, in which a statue of Charles XIII. has been erected; and near it is the play-house. Among the churches of this part of Stockholm, that of Adolphus Frederick is distinguished by its beauty. At the northern extremity of Norr Malm is the observatory, which is well provided with astronomical instruments and a library; and somewhat farther is the botanical garden. The island of Kungsholmen, which lies west of Norr Malm, is joined to it by two bridges. It is not much built on, but contains the great iron-foundry established by an Englishman, Mr. Owen; a large hospital, the Bible printing-office, and the royal cannon-foundry of Marieberg. Contiguous to the Norr Malm on the east is Ladugords Gärdet, on which formerly were some royal farms, a part of which however has been built upon; whilst another part has been converted into a royal park, called Humblegord (hop-garden), to which the public has access. The island of Blasii Holmen, which has been converted into a peninsula by filling up the narrow channel which divided it from the continent, is north-east of Stockholmen and south-east of Norr Malm, of which it now constitutes a portion. It contains some fine buildings. Contiguous to it, and only separated by a narrow channel, over which there is a bridge, is the small island of Kyrkholmen, from which a long wooden bridge leads to Skeppsholmen, where the flotilla of the skära is stationed. Another wooden bridge leads to Kastellholmen, a very elevated island, planted with fine trees: a castle is built here for the defence of the entrance of the harbour.

There is probably no capital in Europe, except perhaps Constantinople, which can be compared with Stockholm as to the beauty of its environs. The numerous channels between the islands—in some places contracted to the narrowness of a river, and at a short distance expanding to the dimensions of a lake, enclosed by a rocky bank, changing continually in elevation and form, and overgrown with beech, birch, and pines, and at several places cut by narrow valleys, partly cultivated and partly covered with meadows—present an infinite variety. Country-houses are dispersed over the hills surrounding the town; but the place which is most resorted to for pleasure is the zoological garden, which lies eastward of the town, and is separated from the Skeppsholmen and Kastellholmen by a narrow arm of the sea. It is a peninsula two miles long and about one mile wide, and its surface is diversified by groves of birch, beech, and pines, by steep rocks and numerous depressions, frequently covered with a fine turf. Within the zoological garden is the royal country-seat of Johansdal, formerly called Rosendal, which is surrounded by a large park. Other royal country-houses are north of Norr Malm, as Ulriksdal, Haga, and Carlsberg: the last is now a military academy. But the most distinguished of the royal country-houses lie to the west of the town, on islands in the lake of Mälern; they are Gripsholm, Drottningholm, and Swartsjö. Drottningholm is an edifice distinguished by great beauty, and contains a fine collection of pictures and coins. Swartsjö is surrounded by an extensive park.

Stockholm is the seat of the government, and generally also the place where the legislative bodies meet. It contains consequently the offices of all the branches of administration and the superior courts of justice. There are several scientific and literary societies, among which the Royal Society of Sciences has greatly contributed to the advancement of natural philosophy, chemistry, and natural history. There is also a Royal Academy of literature, history, and antiquities; the Swedish Academy, whose object is to promote the cultivation of the native language; an academy of military sciences, an academy of liberal arts, a musical academy, and an academy of agriculture. The charitable institutions are very numerous, and in this respect Stockholm is superior to any other city in Europe of equal size. The institutions for education are also numerous. Besides a well-conducted grammar-school, there are some schools for the middling classes, and 14 elementary schools, mostly conducted on the plan of Bell and Lancaster. There is also a school for grown-up persons whose education has been neglected, and who wish to improve their knowledge.

The population of Stockholm consisted, according to the census of 1825, of 79,473 individuals; in 1833, according to Forsell's account, of 81,000; and in 1839, of 83,585 persons, according to the same authority. The number of families in 1825 was 14,436, of which 1314 were rather wealthy, 8777 in comfortable circumstances, and 4345 poor. The number of persons employed by government and their families, the military included, did not exceed 8453; and

the remainder consisted of merchants, tradesmen, mechanics, and seamen, with their families, and the persons attached to their business.

Stockholm is the most industrious and commercial town of Sweden. There are manufactures of cloth, cotton, calico, silk, ribands, sugar, tobacco, leather, cast-iron, and soap. But no branch of manufacturing industry is carried to such an extent, either in Stockholm or in any other place in Sweden, as to supply the demand, and large quantities of foreign manufactures, and especially English, are annually imported.

The commerce of Stockholm is more important. Nearly the whole of the superfluous produce of the countries north and west of Stockholm is brought here, to be exported to foreign countries. It is mostly shipped in Swedish vessels, of which in 1827 Stockholm possessed 146, with nearly 27,900 tons burden, and crews amounting to 1507 persons. The most important article of export is iron: according to an average of ten years (1821-1830), it amounted annually to 31,993 tons. The second article is timber, boards, &c.; and the third is tar and pitch. Minor articles are copper, cobalt, ready-built vessels, linseed-oil and oil-cakes, tobacco, steel, bricks, and a few manufactured articles. The most active commerce is carried on with England, the United States of North America, Denmark, France, Prussia, Portugal, the Netherlands, and Italy. The most important articles of import are sugar, coffee, wine and brandy, rum, woollen manufactured goods, cotton, silk, linens, china and crockery, hemp, cotton, cheese, potash, hides and skins, tallow and candles, train-oil, dyeing-woods, raisins, almonds, pepper, cinnamon and cassia, tea, butter, and wool.

(Forsell's *Statistik von Schweden*; Forsell's *Anteckningar öfver Sverige*, Stockh., 1839; and Schubert's *Reise durch Schweden, Norwegen, Lapland*, &c.)

STOCKING WEAVING. [WEAVING.]

STOCKPORT, an important manufacturing town and parliamentary and municipal borough, on the river Mersey, partly in the parish of Manchester, in the hundred of Salford, in the county of Lancaster, but chiefly in the hundred of Macclesfield, in the county of Chester, 180 miles north-west from the General Post-office, London, by the coach (formerly mail) road, through Barnet, St. Albans, Northampton, Leicester, Derby, Ashbourn, Leek, and Macclesfield, and about seven miles south-east from Manchester.

Stockport, antiently called Stokeporte and Stocport, was made a free borough by Robert de Stokeporte, with the permission of Edward I. as earl of Chester: the same Robert had the grant of a market and an annual fair. There was an antient castle at Stokeport, of which not a vestige now remains. The town was garrisoned by the Parliamentarians in the great civil war, and was taken, A.D. 1644, by the Royalists, under Prince Rupert, who had previously repulsed the garrison, 3000 in number, when they marched out to attack him: the Parliamentarians subsequently recovered the place. Stockport-bridge was blown up in 1745, to prevent the retreat of the rebels after their advance to Derby; and they were in consequence obliged to wade through the river.

The parish of Stockport, which is wholly in Cheshire, comprehends an area of 24,810 acres, with a population of 66,610: it is divided into fourteen chapelries or townships, of which the township of Stockport (which coincided with the antient borough) had an area of 1710 acres, with a population of 25,469; but the town having extended beyond the township, and across the Mersey, into Lancashire, the parliamentary boundaries were, by the Boundary Act, made to comprehend, in addition, the most populous parts of the township of Heaton Norris (in Manchester parish), part of the township of Brinnington, in Stockport parish, and the hamlets of Brinksway and Edgeley, in the townships of Cheadle Bulkeley and Cheadle Moseley, in Cheadle parish; the whole having a population of about 43,000. The town stands at the junction of the rivers Tame and Mersey, and consists of a number of streets irregularly laid out, with a large open market-place in the centre. It is well paved under the provisions of the general Highway Act, and is lighted with gas under a local act. The principal part of the town is built on a steep and irregular hill of soft red sandstone, rising in some parts precipitously from the south bank of the Mersey. The market-place and the parish church are on a tolerably extensive level on the summit of the hill; the streets leading to them are steep and narrow. There are four bridges in or near the town, over the Mersey, and one over the Tame. The 'old bridge' over the Mersey, near the market-place, is of one arch, built high above the river to avoid the inconvenience caused by the sudden and violent swelling of the stream, and having its abutments built on the solid rock, which here lines the banks of the river. Below the 'old bridge' is another bridge, of eleven arches, crossing not only the river, but its valley, at an elevation of 40 feet above the water. The arch over the river is of 90 feet span; most of the dry arches are on the Cheshire side. This bridge was built that the Manchester and Buxton turnpike-road might avoid the ascent and descent caused by the uneven site of the town.

The parish church is, for the most part, modern, having been rebuilt early in the present century, in the perpendicular style of architecture. It has a tower with pinnacles and pierced battlements, a nave with side aisles, and a chancel. The chancel is the sole remaining part of the former building, but it has been much altered. It had a fine east window of decorated English character, but much decayed, the old church having been built of soft red-sandstone: there were also some fine stone stalls in the south wall of the chancel. There are three other places of worship of the establishment in the borough, viz. St. Thomas's church, built A.D. 1825, a handsome building of Grecian architecture, with a tower surmounted by a cupola; St. Peter's chapel, a neat brick building, erected about the middle of the last century; and a district chapel of modern erection in Heaton Norris. Besides these, there are a number of dissenting meeting-houses of different persuasions. There were, in 1834, three for Independents, three for Methodists, and one each for Baptists, Unitarians, Roman Catholics, and Quakers. There are some very large Sunday school-rooms, built by subscription at a cost of above 6500*l.*; a grammar-school, lately rebuilt by the Goldsmiths' Company of London; a very large national school, an infirmary, which is a very ornamental building, and a small theatre.

Stockport is one of the principal seats of the cotton manufacture. Pigott's 'Directory' for 1834 enumerates nearly one hundred and twenty firms in Stockport and Heaton Norris engaged in different branches of this manufacture; there are also three cotton-printing establishments, two bleaching establishments, and several dye-houses. To the cotton manufacture, which is the staple of the town, may be added the manufacture of silk goods, thread, hats, brushes, spindles, and shuttles. About 4500 men were, in 1831, engaged in manufactures in and round the town. There are several breweries, a distillery, several iron and brass foundries in the town, and a great number of bricks are made in the neighbourhood. There are three banking establishments. A branch canal communicates with the Manchester and Ashton canal, and the town is on the line of the Manchester and Birmingham Railway, which has been opened between Manchester and Stockport. The market is on Friday, and is the most important in Cheshire for corn, oatmeal, and cheese. There are four yearly fairs, chiefly for cattle.

Stockport was formerly incorporated, but the corporation, previously to the late Municipal Reform Act, had gone to decay; a mayor was chosen at the court leet and baron of the manor; but his office was merely nominal, the jurisdiction of the town being in the hands of the county magistrates. By the Reform Act Stockport was made a parliamentary borough to return two members; the boundaries of the borough have been already described. The number of voters, in 1835-6, was 1137; in 1839-40, 1279. By the Municipal Reform Act the parliamentary boundaries were adopted for municipal purposes, the borough was divided into seven wards, a number which the revising barristers reduced to six; the town council consists of fourteen aldermen and forty-two councillors, and the town has a commission of the peace.

Stockport has an auxiliary Bible society, a news-room, and a subscription library. Two newspapers, 'The Stockport Advertiser' and 'The Stockport Chronicle,' are published in the town.

The living of Stockport is a rectory, in the rural deanery of Macclesfield, and in the archdeaconry and diocese of Chester, of the clear yearly value of 1882*l.*, with a glebe-house. The chapelries of St. Thomas and St. Peter are curacies, of the clear yearly value of 110*l.* and 220*l.* respectively; Heaton Norris is a chapelry, in the parish and rural deanery of Manchester and in the same archdeaconry and diocese as

Stockport; its clear yearly value is 116*l.* The townships of Stockport, Brinnington, Heaton Norris, Cheadle Bulkeley, and Cheadle Moseley, which are wholly or partly in the borough, had the following number of schools in 1833:—

	Day Schools.	Scholars.	Sunday Schools.	Scholars.
Stockport .	50	1962	8	7259
Brinnington .	2	114	..	..
Heaton Norris	9	481	4	1141
Cheadle Bulkeley	9	336	3	653
Cheadle Moseley	4	163	1	345
	74	3056	16	9398.

One of the day-schools at Stockport is an endowed grammar-school, under the patronage of the Goldsmiths' Company of London. It had, in 1833, 150 boys; another was a national school, with 235 boys and 170 girls. One of the Sunday-schools, 'the Stockport Sunday-school,' was not exclusively connected with any denomination. The Bible was used as the school-book, and the children were taken alternately to church and to dissenting places of worship. This school, with four branches, had, in 1833, 5244 scholars, about half of each sex. It was supported by subscription, and was under the management of a committee elected from among the subscribers of a guinea and upwards, and of visitors chosen from among the persons actively engaged in the school. There were two libraries, a teachers' library of 850 volumes, and a scholars' library of 1700. There were connected with the school a religious tract society which circulated yearly 30,000 tracts, and a Bible association which distributed yearly about 400 copies of the Scriptures. There were no paid officers connected with the institution.

STOCKS, in Horticulture, are young trees which are designed for the reception of the grafts or buds from other trees. The process by which a part of one tree is transferred to another is called grafting or budding [GRAFTING], and the object attained by it in gardening is the securing the continuance and multiplication of an individual plant that may possess peculiarities deemed worthy of preservation. It is by this process that the great number of varieties of cultivated fruits are preserved with remarkable integrity, and by which a constant improvement may be ensured.

In the process of grafting much depends on the stocks which are employed, and it is by ascertaining the best modes of growing stocks, and the relation that exists between the various kinds of stocks and the grafts and buds that are placed upon them, that we are to look for the improvement of the various kinds of garden fruit.

Stocks are for practical purposes divided into three kinds. Crab stocks, free stocks, and dwarf stocks. Crab stocks are those which are grown from the seeds of wild and ungrafted trees, as the cherry, plum, apple, &c. These stocks are commonly used where a large and hardy growth is desirable. In the selection of wild stocks, those which grow cleanest, and are freest from irregularities of the stem and defects in the bark, should be chosen. Free stocks are those which are raised from the seeds or layers of fruit and orchard trees which have been grafted. These stocks are found desirable when the object of grafting is to obtain choice varieties of apples, peaches, nectarines, apricots, or plums. Dwarf stocks are those which are raised from low-growing shrubby trees. They are used in the grafting of low-standards for small gardens, also for wall-trees, and espaliers.

Stocks are raised in nurseries from seeds, suckers, layers, and cuttings. When raised from seeds, they should be sown in the autumn, in beds of common light earth: all lateral branches should be cut off as they grow up; and, according to circumstances, they will be fit for grafting in one, two, or three years. Stocks may be used when they have attained the size of a goose-quill, up to that of a man's finger. When stocks are wanted expeditiously, they may be produced from suckers taken up and planted in the autumn, when they will be ready for use the following July or August. They are not often raised from layers and cuttings.

In the selection of stocks, not only is care required that they be of the same kind as the graft or scion, but that there is a proper relation between the rapidity of their growth according to the objects wished to be attained. When the growth of the scion is more rapid than that of the stock, it will sometimes die. This is the case with peach-trees budded on plum-stocks and pears on the hawthorn. At the same time, when trees are naturally too luxuriant in leaves and branches, they may be dwarfed in their growth and made fruitful by placing a scion from them on a stock that grows slower than themselves. In this way apples may be dwarfed by being grown on paradise, pear, or quince stocks. Of this fact Knight gives the following explanation:—'The disposition in young trees to produce and nourish blossoms, buds, and fruits, is increased by this apparent obstruction of the descending sap; and the fruit of such young trees ripens, I think, somewhat earlier than upon other young trees of the same age which grow upon stocks of their own species; but the growth and vigour of the tree, and its power to nourish a succession of heavy crops, are diminished, apparently by the stagnation, in the branches and stock, of a portion of that sap which, in a tree growing upon its own stem or a stock of its own species, would descend to nourish and promote the extension of the roots. The practice therefore of grafting the pear-tree on the quince-stock, and the peach and apricot on the plum, where extensive growth and durability are required, is wrong; but it is eligible wherever it is wished to diminish the vigour and growth of the tree, and where its durability is not thought important.' (*Hort. Trans.*, ii.)

It is frequently desirable to select those stocks which are hardier than the scion, for the purpose of ensuring the growth of the latter. Not that the stock has any power of communicating hardiness to the scion; but those stocks that are accustomed to colder latitudes will supply a sufficient quantity of sap, and be able to resist the influence of a decrease of bottom heat.

M. Dubreuille of Rouen has lately pointed out the fact that the kind of soil in which a stock grows has something to do with its being adapted for the growth of certain scions Thus he found that in the chalky gardens about that city, neither the plum nor the wild cherry would do as stocks for stone-fruit, nor the doucin or quince stock for pears and apples. The crab was found best for the apple, the wild pear for the cultivated pear, the almond for the plum, and the mahaleb for the cherry.

The following table, from Dr. Lindley's 'Theory of Horticulture,' p. 24, gives a comparative view of the stocks that were found best suited for the scions of the apple, pear, plum, and cherry, in three different soils:—

Scions.	*Stocks.* Loamy soil.	Chalk soil.	Light soil.
Apple .	Doucin.	Crab.	Doucin.
Pear .	Quince.	Wild pear.	Quince.
Plum .	Plum.	Almond.	Almond.
Cherry .	Wild cherry.	Mahaleb.	Wild cherry.

It has long been known that many scions did better on another species of stock than on their own, but it was not known that soil could have any influence on this; and hence is opened a field of interesting inquiry for the vegetable physiologist and horticulturist.

STOCKS, a term applied to the various 'Funds' which constitute the national debt. The number of distinct accounts of stock on which dividends were paid in 1839 was as follows:—

Dividends not exceeding		Dividends not exceeding	
£ 5 . .	85,069	£ 500 . .	2827
10 . .	45,147	1000 . .	1367
50 . .	98,946	2000 . .	266
100 . .	26,205		
200 . .	14,816	Exceeding	
300 . .	4,495	2000 . .	192

Each proprietor of stock may transfer his interest to others by sale. When the transfer is effected by a broker he must be authorised by a power of attorney from his principal, the stamp-duty on which is 21*s.* 6*d.*; and the document may be so drawn as to empower him both to buy and sell stock and to receive the dividends for the person by whom he is commissioned. Few persons buy or sell stock except through the medium of a broker, but the general practice is to receive their dividends themselves. The purchaser acquires the dividend due upon the stock for the current half-year, and thus at one point there will be a sum of 29*s.* 4*d.* due on three-per-cent. stock, and a fortnight afterwards only 1*s.* 8*d.* On the bargain being completed, the parties repair to the Bank or South Sea House (according to the stock), where the actual transfer is effected. 'For this purpose the seller makes out a note in writing, which contains the name and designation of the seller and purchaser, and the sum and description of the stock to be transferred. He delivers this to the proper

clerk, and then fills up a receipt, a printed form of which, with blanks, is obtained at the office. The clerk, in the mean time, examines the seller's accounts: and if he find him possessed of the stock proposed to be sold, he makes out the transfer. This is signed in the books by the seller, who delivers the receipt to the clerk; and upon the purchaser's signing his acceptance in the book, the clerk signs the receipt as witness. It is then delivered to the purchaser upon payment of the money, and thus the business is completed.' (Dr. Hamilton, *History of the National Debt.*)

Bargains in stock are transacted in the Stock Exchange, in Capel-court, Bartholomew-lane. Brokers and jobbers who are not members assemble in the open court in front of the building. All the more respectable brokers are members of the Stock Exchange, into which association they are elected annually by ballot; but many of the jobbers are said to be persons of wealth. The governing body consists of a committee of twenty-four, also elected by ballot. The established rate of brokerage is one-eighth per cent. (or 2*s.* 6*d.* in the 100*l.*) upon the amount of stock transferred. There is no stamp-duty or tax of any kind upon transfers of Government Stock; but the transfer of Bank Stock under 25*l.* costs 9*s.*, above that amount, 12*s.*; of South Sea Stock under 100*l.*, 10*s.*, above it, 12*s.*; and of India Stock, of any amount, 1*l.* 12*s.*

The dividends on all descriptions of stock are due half-yearly, either on the 5th of January and 5th of July, or on the 5th of April and 10th of October, and are paid about a week afterwards; and for about six weeks previously, the books at the Transfer Office being closed, transfers cannot be regularly made. The transfers on each stock are effected at other times only on certain days in the week, which may be ascertained by a reference to any Almanac.

The bargains for *time* form a very important portion of the business of the Stock Exchange. They are bargains to deliver stock on a certain day at a certain price, the seller of course believing that the price will fall, and the buyer that it will rise. When the period for completing the bargain has arrived, a settlement is usually effected without any payment of stock, the losing party simply paying the difference. 'These bargains are usually made for certain days fixed by a committee of the Stock Exchange, called *settling days*, of which there are about eight in the year, viz. one in each of the months of January, February, April, May, July, August, October, and November; and they are always on Tuesday, Wednesday, Thursday, or Friday, being the days on which the commissioners for the reduction of the national debt make purchases. The settling days in January and July are always the first days of the opening of the Bank books for public transfer; and these days are notified at the Bank, when the books are shut to prepare for the dividend. The price at which stock is sold to be transferred on the next settling day is called the price *on account.* Sometimes, instead of closing the account on the settling day, the stock is carried on to a future day on such terms as the parties agree on. This is called a *continuation.*' (Dr. Hamilton.) Time bargains cannot be enforced in a court of law, and the parties are held to them only by a sense of honour and self-interest, and the fear of exclusion from the Stock Exchange, which ruins their credit. A defaulter, in the language of the Stock Exchange, is termed a 'lame duck,' and his name is posted for a certain time in the great room. The sellers of time bargains are also technically called 'bears,' and the buyers 'bulls;' the interest of the former being to beat down prices, and of the latter to raise them.

Stock of a high denomination may usually be bought cheaper than that of which the nominal interest is lower; and it is therefore the most advantageous for temporary investment. There is always a probability that the stock bearing the highest rate of interest will be reduced by the government when a favourable occasion presents itself; but the price of any one stock may be taken pretty nearly as an indication of the prices of the rest. For example, when 100*l.* in three per cent. stock costs 90*l.*, the par would be 105*l.* in a three and a half per cent. stock. When the Government reduces the interest on a particular stock, it is guaranteed against further reduction for a specified period; and this period having expired in regard to the New Three and a half per Cent. Stock, its relative value, compared with the Three per Cent. Stock, is as 90 to 99, there being always a probability that the interest on the former may be reduced. The fluctuation in the price of stocks generally may be traced to an almost infinite variety of causes—to the abundance or scarcity of money, and the opportunities of employing it to advantage in mercantile speculations; to the rumours of a new loan, or of the imposition of a fresh tax, or even the repeal of a tax; to rumours of war; and to innumerable other circumstances relating to the trade, finance, and other domestic affairs of the country. In 1797 the Three per Cents. were reduced to the lowest point which they have ever reached (47⅞) by the success of the French armies, combined with adverse circumstances at home.

The following is a brief notice of each description of stock at present existing, which are bought and sold on the Stock Exchange, with the amount of each on the 5th of January, 1841:—

1. South Sea Stock, divided into the Company's Stock, or trading capital, amounting to 3,662,784*l.*; Old South Sea Annuities, 3,497,870*l.*; New South Sea Annuities, 2,460,830*l.*; and South Sea Annuities of 1751, 523,100*l.*, all of which have been created out of the capital of the famous South Sea Company by successive Parliamentary arrangements. The interest paid by the State upon the whole amount of this stock is now 3 per cent., although the dividend received by the proprietors of the 3,662,784*l.* of Company's trading stock is 3½ per cent. The additional half per cent. is obtained from certain fines and from the allowances made by Government for the management of this portion of the public debt.

2. Debts due to the Bank of England, amounting to 14,686,800*l.*, advanced at different times by the Bank to the public; the Bank receives interest on the amount at the rate of 3 per cent.

3. Bank Annuities, created in 1726, amounting to 825,251*l.* This stock was originally 1,000,000*l.*, which was raised in 1726, by lottery, to pay off arrears that had accumulated on the Civil List, and for which Exchequer bills had been previously issued: it bears interest at 3 per cent.

4. Consolidated Annuities, commonly called Three per cent. Consols. The amount of this stock, in January, 1841, was 362,542,977*l.* It was originally formed by the union of several funds which had before been kept separate, in the year 1751, at which period it was little more than 9,000,000*l.*

5. Three per Cent. Reduced Annuities, amounting to 125,861,030*l.* This stock consists of various sums originally borrowed at a higher rate of interest, but on which the interest has been afterwards reduced at different times.

6. Annuities at 3½ per Cent., 1818, amounting to 10,159,721*l.* Formed in 1818, partly by the funding of Exchequer bills, and partly by the conversion of certain 3 per cent. consolidated and 3 per cent. reduced annuities.

7. Reduced 3½ per Cent. Annuities, amounting to 66,259,849*l.* Formed in 1824, by the conversion of a former stock called the Old Four per Cents.

8. New 3½ per Cent. Annuities, amounting to 145,225,865*l.* Formed in 1830 out of the former stock called the New Four per Cents.

9. New 5 per Cent. Annuities, amounting to 428,076*l.* Formed in 1830, by the same arrangement out of which the New 3½ per Cent. Annuities then arose.

The total amount of the Irish Stocks, on the 5th of January, 1841, was 33,909,266*l.*

Besides these several stocks, there are—

1. The Long Annuities, occasioning an annual charge of 1,294,140*l.* These have been granted at different times, chiefly as premiums or douceurs to the subscribers to loans, and all expire on the 5th of January, 1860.

2. The Annuities per 4 Geo. IV., ch. 22, commonly called The Dead Weight Annuity. This is an annuity of 585,740*l.* paid every year by the public to the Bank of England, and to be so paid till the year 1867, in consideration of advances to the amount of 13,089,419*l.* made by that establishment. [NATIONAL DEBT.]

3. Life Annuities per 48 Geo. III., ch. 142, 10 Geo. IV., ch. 24, and 3 Will. IV., ch. 14, occasioning a charge of 857,856*l.* These are annuities upon the lives of individuals, which the Commissioners for the redemption of the National Debt were originally empowered to grant by an Act passed in 1808, in exchange for so much stock in interminable annuities as was calculated to be of equivalent value, according to a scale varying with the fluctuations in the prices of stocks. In 1829, however, Mr. Finlaison, the Government actuary, discovered that the tables which had been all along used in these calculations were erroneous,

when the Act upon which the annuities are now granted was passed.

4. Annuities for terms of years, under the above Acts, of which the present charge is 1,314,927*l.* These annuities are granted for various terms of ten years and upwards.

5. There are certain Tontines, and other Life Annuities granted by various Acts, of which those forming part of the English debt occasioned, in January, 1841, a charge of 9,969*l.*, and those forming part of the Irish debt, a charge of 34,230*l.*

The two following descriptions of stock, in addition to the above, are constantly operated upon by the sale and purchase of shares at the Stock Exchange.

1. Bank Stock, being the trading capital of the Bank of England, or that upon which interest is paid to the proprietors, amounting formerly to 14,553,000*l.*, but since the last renewal of the charter, in 1833, to only 10,914,250*l.* The interest is 8 per cent.

2. East India Stock, or the capital belonging to the East India Company, amounting to 6,000,000*l.* Ever since 1793 the interest upon this stock has been 10½ per cent.

Besides these English funds, shares in many descriptions of foreign stocks, which have been created by loans raised in this country, are constantly for sale in the money-market, as are also shares in railway, canal, mining, and numerous other similar speculations.

STOCKS, a wooden machine formerly much used for the punishment of disorderly persons by securing their legs. The time when they were first used in England does not appear; but in the second Statute of Labourers, 25 Edw. III., A.D. 1350, in the octave of the Purification, it is enacted that refractory artificers shall be put in the stocks by the lords, stewards, bailiffs, or constables of the towns where their offence has been committed, by three days; or sent to the next gaol, there to justify themselves; and that stocks be made in every town for such occasion between that time and the feast of Pentecost. (*Rot. Parl.*, ii., 234.) In 1376 the commons prayed the king for their establishment in every village. (*Ibid.*, 341.)

In 'King Lear,' act ii., sc. 2, Shakspere has introduced the stocks upon the stage. Farmer, commenting upon the passage (see Malone's *Shaksp.*, edit. 1821, vol. x., p. 99), says, 'It should be remembered, that formerly in great houses, as still in some colleges, there were moveable stocks for the correction of the servants.' The last pair of stocks seen in London remained till within these very few years in Portugal-street, Lincoln's-Inn-Fields. A whipping-post usually adjoined the stocks.

STOCKTON, distinguished as STOCKTON-UPON-TEES, a town in the south-west division of Stockton ward, in the county of Durham, 340½ miles from the General-Post-office, London, by railway through Birmingham, Warrington, Manchester, Normanton, York, and Darlington; or 212½ miles by the coach (formerly mail) road through Barnet, Biggleswade, Norman Cross, Stamford, Grantham, Newark, East Retford, Doncaster, Abberford, Boroughbridge, Thirsk, and Yarm.

Stockton was at an early period the residence of the bishops of Durham, who had a hall here, which afterwards was called the castle, though in fact only a strong moated manor-house, where Bishop Morton took refuge (A.D. 1640) when the army of Charles I. was defeated by the Scots in the skirmish at Newburn. In 1645 the town was occupied by the Scotch army; and in 1647 the castle was ordered by parliament to be dismantled, and was entirely demolished in 1652. It commanded the passage of the river. The traces of the moat and embankment still mark the site.

The town is situated on the left bank of the Tees, which approaches the town in a northward direction, and then makes a sudden bend toward the east. The town is laid out with considerable regularity; the principal street is broad, and extends nearly a mile in a straight line from south to north: other streets either branch from this at right angles or run parallel to it. The wharf is on the bank of the river, just above the bend, and runs parallel to the High Street. Near the south end of the High Street the London and Darlington roads, united, enter it from the west; and quite at its southern extremity a road from it bends first to the south-east, then to the east, and crosses the Tees into Yorkshire by a stone bridge of five arches, erected (A.D. 1764-1771) in the place of the previously-existing ferry. The streets are well paved, and lighted with gas, under a local act. The houses are for the most part of brick; the few that are built of stone are from the materials of the castle. The church is on the east side of the High Street, and at the eastern end of the church is a green, now inclosed and formed into a square. Altogether Stockton is one of the handsomest and cleanest towns in the north of England. The church is a spacious and convenient brick building, erected early in the last century, with a tower at the west end 80 feet high. There are places of worship for Independents, Baptists, Unitarians, Quakers, Wesleyan and Primitive Methodists, and Roman Catholics. The town-hall, in the middle of the High Street, is a respectable quadrangular building, surmounted by a clock tower and spire. There are a custom-house, a news-room, assembly-rooms, billiard-rooms, and a small theatre. There is a race-course on the opposite side of the Tees.

The parish of Stockton comprehends an area of 4190 acres: the population, in 1831, was 7991: it is divided into the three townships of Stockton, Hartburn, and Preston: the township of Stockton, which contains the town, has an area of 2610 acres, with a population, in 1831, of 7763. The principal manufacture is that of linen and sail-cloth, which latter employs 400 hands: some ship-building, rope and sail making, and yarn and worsted spinning are carried on: there are also iron and brass foundries, breweries, and several corn mills. Stockton is a port: the harbour is formed by the river Tees, the navigation of which has been improved by a cut just below the town, whereby a considerable bend is avoided. The chief imports are timber, deals, masts, spars, staves, iron, hemp, flax, tallow, oak-bark, linseed, clover-seed, hides, &c., chiefly from the Baltic, Holland, Hamburg, and British America; and groceries, wine, spirits, and colonial produce, brought coastwise. The exports to foreign parts are chiefly lead, and that in small quantities: the exports coastwise to London, Leith, Hull, Sunderland, &c, are chiefly of flour, butter, cheese, bacon, oak timber, linen, linen and worsted yarn, lead, and especially coal, the export of which has much increased. Communication is maintained with London and with Newcastle-upon-Tyne by steam-packets; and with Darlington, York, Manchester, Birmingham, and London by railway. The Stockton and Darlington Railway, which forms the first part of this line of communication, has one terminus on the quay, in the very heart of the town, and extends by Yarm and Darlington to Witton Colliery, near Bishop Auckland. A branch to Middlesbrough, a rising port in Yorkshire, lower down on the Tees, parts from the main line just to the south of the town of Stockton, and is carried over the Tees by a suspension bridge (just above the stone bridge at Stockton), 240 feet long within the piers, and 30 feet above low-water mark. This railway was commenced under an act obtained in 1821, and was opened in 1825. Its whole length with the branches is 54 miles: it is the first railway on which locomotive engines were employed. A branch of the Clarence Railway (which extends from the Stockton and Darlington Railway, between Darlington and Bishop Auckland, to the mouth of the Tees, on the Durham side), has its terminus on the east side of the town. There are two weekly markets (Wednesday and Saturday) and two yearly fairs, besides a cattle-fair or great market on the last Wednesday of every month. There are four banking establishments at Stockton. There are extensive coal-works and some brick-yards near the town, and a salmon and other fishery in the Tees.

Stockton has a savings'-bank, a mechanics' institution, a dispensary, and almshouses.

Stockton is a borough by prescription; it has no charter, nor had the corporate officers any jurisdiction. Petty-sessions were held weekly by the county magistrates for Stockton ward. The borough comprehended only a small portion of the town; but a considerable extension of its limits has been recommended. By the Municipal Corporations' Reform Act the borough was divided into two wards, and has six aldermen and eighteen councillors. The borough has now a commission of the peace. Stockton is a polling-station for the southern division of the county of Durham.

The living of Stockton is a vicarage, in the archdeaconry and diocese of Durham, of the clear yearly value of 247*l.*, with a glebe-house.

The township had, in 1833, twenty-one day-schools, with 902 children of both sexes; and five Sunday-schools, with 611 children. Of the day-schools, one, with 203 boys and 70 girls, was supported by endowment; and another, with

40 girls, partly by endowment and partly by annual subscription. The other townships of the parish have no school. A later account enumerates a grammar-school, a national school, a blue-coat charity-school, and seventeen private schools.

STOFFLER, JOHN, a celebrated German astronomer, who was born December 10, 1452, at Justingen in Swabia. He was appointed professor of mathematics in the University of Tübingen (in Wirtemberg), where, besides pure mathematics, he taught astronomy and geography, and he appears to have been successful in gaining the esteem of his numerous pupils, among whom are said to have been Melanchthon and Sebastian Münster. In the year 1530 he made a journey to Vienna, in order to be present at the installation of a professor of mathematics in the University of that city; and, according to Melchior Adam, he died of a contagious malady at Blaubeuren, February 16, in the following year, being 79 years of age. His funeral was celebrated with great magnificence, and his tomb was adorned with his effigy.

According to the practice of astronomers in that age, Stoffler spent much of his time in the computation of ephemerides, and he appears to have been first brought into notice by continuing the series which Müller (Regiomontanus) had commenced. He constructed an astrolabe, which was intended to be used as an instrument for making celestial observations, and on the plane of which were projected the circles of the sphere: an account of the astrolabe was given by him in a tract which was published at Tübingen in 1513; and in the same tract there is given an account of an instrument for determining the hour of the day by an observed altitude of the sun. Stoffler was addicted to the study of astrology; and in the ephemeris for the year 1524 he announced that, in consequence of a conjunction of the superior planets in the month of February, there would happen a deluge which would be fatal to the human race. Many persons had faith in the prediction, and took measures to save themselves, and it is remarkable that the fact of the prediction being found to be erroneous, neither disposed the author to renounce the study of astrology nor diminished the sale of his ephemerides. He published these works in a regular series from the year 1500 to about 1531.

Stoffler employed himself on the subject of reforming the Julian Calendar, and it is stated that he was the first who proposed to rectify the error of that calendar by the omission of ten days in one year, in order to make the succeeding days of the year correspond, as at first, to the place of the sun in the ecliptic. It is said also that Stoffler offered his project to the Lateran council, and that it was not accepted.

Besides the ephemerides, and the above-mentioned tract on the use of the astrolabe, Stoffler published astronomical tables (Tübingen, 1500); a tract on the calendar (Oppenheim, 1518); and a commentary on the Sphere of Proclus (Tübingen, 1531)

STOICS. [ZENO.]

STOKE, distinguished as STOKE-UPON-TRENT, one of the new parliamentary boroughs created by the Reform Act, in the northern division of Pyrehill hundred, in the county of Stafford. Stoke, which gives name to the borough, and Burslem, one of the principal towns in it, are each 152 miles north-west from the General Post-office, London, by Barnet, St. Albans, Daventry, Coventry, Coleshill, Lichfield, Stone, and Newcastle-under-Lyne; or 162 miles by the Birmingham and Grand Junction railways to Stafford, and from thence by Sandon and Newcastle. Hanley, the largest town in the district, is about a mile farther.

This borough has this peculiarity, that instead of comprehending one principal town and its suburbs, it consists of a considerable district, extending 7½ miles in length from north-north-west to south-south-east, and above 3 miles in breadth at the widest part. It includes the township or liberty of Tunstall Court in Wolstanton parish; the township of Burslem with the vill of Rushton Grange and the hamlet of Sneyd, in Burslem parish; and the chapelries of Hanley and Lane-End, and the townships of Shelton, Penkhull, Boothen, Fenton-Vivian, Fenton-Culvert, and Longton, in Stoke parish. In this district, the chief seat of the earthenware manufacture of England, familiarly designated 'the Potteries,' are the market-towns of Burslem, Hanley, Lane-End, Stoke, and Tunstall Court. The district is of no historical interest; its importance has arisen from the manufacture of which it is the seat. [EARTHENWARE.] Burslem is described elsewhere. [BURSLEM.]

Hanley is near the centre of the district, about a mile from Stoke. It is united with Shelton into one market-town, the largest in the district. It stands on the south-western slope of a gently rising eminence. Most of the streets have been laid out within the present century; they are wide and have a brick pavement for foot passengers on each side, and are lighted with gas. There are some spacious and elegant houses, but the generality are smaller and of tolerably uniform height, viz. of two stories. The market-place is large and surrounded by spacious shops; in it is a pump or fountain, in the form of a Doric pillar of cast-iron, surmounted by a lamp. The market-hall is convenient; in one corner is the watch-house, in another corner is a two-celled prison or lock-up-house. The church, or rather chapel, at Hanley is a commodious brick building with a tower 100 feet high. A new church has been built in Shelton. There is a neat building for the national school, and a handsome one for a British school. There are several places of worship for different classes of Dissenters; that for the Methodist New Connection has a large Sunday-school room attached to it, capable of containing 1000 children.

The population of Hanley chapelry and Shelton township, in 1831, was 16,388: 1444 men were returned as engaged in manufactures; they were nearly all engaged in the earthenware manufacture, in which they were assisted by their families. There is one banking establishment, and there is a large paper-mill of modern erection. Etruria, a long street of about one hundred and twenty houses, with a Wesleyan Methodist chapel and a large British school, an extensive earthenware manufactory (Wedgwood's) and a mansion (Etruria Hall), erected by Josiah Wedgwood, the great improver of the earthenware manufacture of the district [EARTHENWARE, vol. ix., p. 243] is in Shelton township, and its population is included above. These are well supplied markets on Wednesday and Saturday, the latter being the principal; the tolls, which a few years since produced 700*l.* per annum, are appropriated to the improvement of the town.

Lane-End is at the south-south-east extremity of the district, about three miles from Stoke. It was formerly remarkable for the irregularity with which it was laid out, but the more modern parts are regularly laid out, and built with tolerable uniformity. There are two places of worship of the establishment; one built, or rather rebuilt, in 1795, the other in 1834; several Dissenting or Methodist meeting-houses, and a Catholic chapel; an English free-school, and a large national school. Lane-End has two market-places: one, with regular shambles and stalls, is used for the weekly market; the other, with a spacious market-hall, commonly used for public meetings, is appropriated for the yearly fairs. The market tolls are devoted to the improvement of the town. The population of the chapelry of Lane-End, and of the township of Longton, into which the town extends, was, in 1831, 9608; of whom 981 men (besides their families or assistants) were employed in manufactures, almost entirely of earthenware. There is an iron-work for smelting the ironstone found in the neighbourhood. There are two banking establishments. The market is on Saturday. There are several yearly fairs.

Stoke has a number of modern houses, regularly laid out. The streets have their footpaths paved with brick, and are lighted with gas. In the centre of the town is the extensive earthenware manufactory of Messrs. Spode and Co, covering an area of several acres. The town-hall is a neat building, well adapted to its purposes, with an engine and lock-up-house beneath. The church is a modern structure, of Gothic architecture, erected in place of an older one now pulled down: it has a tower 112 feet high. There is a handsome and commodious national school adjoining the churchyard. The population of the township of Penkhull, in which the town stands, was, in 1831, 5876, of whom 609 men were employed almost entirely in the manufacture of earthenware. The earthenware manufactories of Stoke are not numerous, but are among the most important in the district. The market is on Saturday, and is well supplied.

Tunstall-court has risen during the present century from a mere hamlet of sixty houses. It is on the declivity of a considerable eminence, about four miles north from Newcastle-under-Lyne. It has a new church, built about ten years since, and three Methodist meeting-houses. The spacious market-place was formed in 1815. There are a market and court house, with lock-up cells for offenders. The

population of Tunstall-court township in 1831 was 3673, of whom only 19 men were returned as employed in manufacture, but there was obviously some mistake in the return here. Earthenware and blue tiles are manufactured; and there are corn-mills and chemical-works. The market is on Saturday.

These are the principal places in the borough, the total population of which, in 1831, was as follows:—

	Houses. Inhab.	Houses. Uninh.	Houses. Build.	Families.	Population.
Burslem, township .	2731	94	11	3042	12,250
Rushton Grange, vill*	..	..	..	..	..
Sneyd, hamlet .	170	4	..	186	963
Hanley, chapelry .	1321	76	18	1402	7,121
Lane-End, do. .	278	18	..	299	1,488
Shelton, township .	1810	61	26	1971	9,267
Penkhull, do. .	1071	38	12	1215	5,876
Boothen, do. .	21	..	..	22	121
Fenton Vivian, do. .	189	18	..	222	1,062
Fenton Culvert, do. .	535	54	21	629	2,708
Longton, do. .	1593	201	7	1815	8,120
	9749	564	95	10,803	47,916

In the borough, or in its immediate neighbourhood, about 4400 men, with their families, were, in 1831, engaged in the manufacture of earthenware. A number of men are employed in the adjacent coal-works. Coals, marl, and potters' clay are dug in the neighbourhood. The potters are generally steady men, as attested by the fact that a greater number reside in houses belonging to themselves, purchased by their savings, than in any other place of equal population in England. Many of them rent small plots of ground, on which they raise in rotation crops of potatoes, wheat, and oats; the straw is used in packing the earthenware. The hazel-rods and coppice-wood of the surrounding district are used in considerable quantity in making crates to pack the earthenware. The Trent and Mersey Canal and the Caldon Canal run through the heart of the Potteries. The Manchester and Birmingham Railway was designed to run through them, but the line has been altered.

The living of Burslem is a rectory, of the clear yearly value of 455*l.*, with a glebe-house; the benefice of the new church at Burslem is a perpetual curacy, of the clear yearly value of 109*l.* The benefice of the new church at Tunstall is a perpetual curacy. The living of Stoke-upon-Trent is a rectory, of the clear yearly value of 2717*l.*, with a glebe-house. The benefices of Hanley, Shelton, Lane-End, and Longton are perpetual curacies. The clear yearly value of Hanley is 226*l.*, and of Lane-End, 151*l.*, each with a glebe-house. All these places are in the rural deanery of Newcastle and Stone, in the archdeaconry of Stafford and diocese of Lichfield. There were in the borough, in 1833, besides private day-schools, two infant-schools, with 164 children: one at Hanley and one at Lane-End; three national schools, namely, the Hanley and Shelton school, with 215 boys and 156 girls; the Stoke-upon-Trent school, with 120 boys and 187 girls; and the Lane-End school, with 103 boys and 64 girls; a Lancasterian or British school at Shelton, with 150 boys and 100 girls, and a Roman Catholic school in Lane-End, with 90 girls. The national schools are attended by many hundred children in addition on Sundays, and there are many Sunday-schools, some of them very large. There are a literary society at Tunstall, and a mechanics' institution called the Pottery Mechanics' Institution. The North Staffordshire Infirmary is in the township of Shelton; it is a spacious and commodious brick building.

The number of voters on the register for 1835-6 was 1445; for 1839-40, 1623, showing an increase in four years of 178. The number of qualifying houses (*i.e.* houses worth 10*l.* a year) in proportion to the population is unusually small, rents being very low, owing to the abundance of building-ground and the cheapness of building materials. The borough returns two members to parliament.

(Shaw's *History of the Staffordshire Potteries; Parliamentary Papers.*)

STOLE, originally a long vestment, a matron's robe, from the Latin *stola*, and that from the Greek στολή. Pitiscus, in his 'Lexicon Antiquitat. Roman.,' has a long article upon the *stola* as worn by the antients.

In later times stola was the term more particularly applied to a broad strip of cloth or stuff, with three crosses upon it, worn by priests of the Romish church as a sacerdotal vestment, with whom it was also called *Orarium*. 'Orarium est stola,' says Lyndwood, in his 'Provinciale,' 'qua sacerdos in omni obsequio divino uti debet, et sao collo imponitur ut significet se jugum Domini suscepisse.'

The stole or orarium, according to Palmer (*Origines Liturgicæ*, vol. ii., pp. 316, 317), has been used from the most primitive ages by the Christian clergy. It is spoken of by the first council of Braga, A.D. 563; by Isidore Hispalensis, A.D. 600: the Council of Laodicea, in Phrygia, A.D. 360; Severianus Gabalitanus, in the time of Chrysostom; and many others (see Bingham's *Antiq.*, b. xiii., c. 8, § 2; and Gerberti, *Liturg. Aleman.*, tom. i., p. 240); and it has been continually used by all the churches of the west and east, and by the Monophysites of Antioch and Alexandria. 'The stole,' says Palmer, 'always called Ὀράριον by the Greeks, was fastened on one shoulder of the deacon's albe, and hung down before and behind. The priest had it over both shoulders, and the two ends of it hung down in front. The Eastern churches call the stole of the priests ἐπιτραχήλιον. Thus simply were the dresses of deacons and priests distinguished from each other in primitive times.'

The pall of the metropolitans was originally only a stole wound round the neck, with the ends hanging down behind and before.

That the word stole, in the sense of a sacerdotal vestment, was of early adoption into the English language, appears from the 'Saxon Chronicle' under the year 963, when Archbishop Dunstan, at the time of personally confirming King Edgar's grant of lands to the monastery of Peterborough, added that he himself gave, among other vestments, his *stol* to St. Peter. (Ingram's *Sax. Chron.*, p. 156.)

STOLE. [STEM.]

STOMACH. One of the most constant characters by which animals are distinguished is the possession of an internal digestive cavity, in which their food is received and subjected to a peculiar chemical change before it is appropriated to the nutrition of the different parts of the body. In some animals the chemical change is effected in every part of the cavity; in others it goes on in one portion of it exclusively, and this portion is named the stomach. Its forms in each of the chief divisions of the animal kingdom are considered in their appropriate articles: in the present, therefore, the anatomy and a part of the physiology of the human stomach alone will be described. Most of the important facts concerning its office are detailed in the article DIGESTION; but since that was published, the knowledge of the process has been greatly increased by some researches into the minute structure of the stomach, the nature of the digestive substance, and the results of artificial digestion.

The human stomach is a membranous sac of an irregularly conical form, which lies almost transversely across the upper and left portion of the abdominal cavity. [ABDOMEN.] Its larger extremity is directed to the left, its smaller to the right. To the left it is in contact with the spleen; to the right, with the liver: above it is covered by the diaphragm, and, at about one-third of the distance from its left to its right extremity, it communicates, by an orifice called the cardia, with the œsophagus: at its right end it opens by another orifice, named pylorus, into the intestinal canal. Of these orifices the pyloric lies rather lower than the cardiac: they are separated from each other by the upper and shorter border, or small arch, of the stomach, the greater part of the cavity being formed as if by the dilatation of the left side of the œsophagus into a great cul-de-sac and great arch, which form the left and inferior boundary of the stomach.

The coats or walls of the stomach are composed of three distinct membranes, connected by a firm but very extensible cellular tissue. The external or peritoneal coat is a layer of fine compact cellular tissue, woven into a thin membrane, and covered by a fine cuticle or epithelium, from which, like all the other organs within the abdominal cavity, it obtains a perfectly smooth and polished surface. The peritoneum invests every part of the stomach except the upper and lower borders, where there are spaces in which the trunks of the blood-vessels run, and from each of which the peritoneum is continued in a double layer to form the greater and less omenta. [OMENTUM.] Its only purpose seems to be to permit the stomach to move easily upon the adjacent organs.

Between the peritoneal and the internal or mucous

* Included, we believe, in Burslem township.

membrane, there is a stratum of loose cellular tissue, in which are inlaid the fibres of the middle or muscular coat. This is composed of three different sets of fibres, resembling in their structure those of most involuntary muscles. [MUSCLES.] The fibres in the first and most superficial layer run longitudinally: they are continued from those of the outer coat of the œsophagus, which, at the cardia, expand or radiate, and pass in fasciculi at some distance apart, from left to right, along both the anterior and posterior surfaces of the stomach. The second layer is composed of circular fibres which form numerous fasciculi, each of which encompasses a considerable portion of the circumference of the stomach. The third and internal layer consists of two principal fasciculi of muscular fibres, which proceed from the cardia and expand over the great cul-de sac and middle portion of the organ. By the differently combined contractions of these fibres, all the motions of the stomach, described under DIGESTION, are performed.

The interior or mucous coat of the stomach is that in which the essential apparatus for the production of the digestive material is placed. To the naked eye it appears a soft spongy membrane, about one-tenth of an inch thick, with a polished slippery surface. After death it varies considerably in its colour, but during life has a light pinkish tinge, and, accordingly as the stomach is distended or contracted, is either perfectly smooth or is thrown into various deep and irregular but chiefly longitudinal wrinkles. At the pylorus it forms a deep fold, between the two layers of which are strong fasciculi of circular muscular fibres: these constitute the pyloric valve, by which the aperture between the stomach and intestines is guarded. At the cardiac orifice the boundary between the mucous membrane of the stomach and that of the œsophagus is marked by a jagged line, at which the thick and opaque epithelium of the latter terminates, and the much finer epithelium lining the stomach commences.

The more intimate structure of the mucous membrane can be seen only with the aid of the microscope. If its surface be examined with a lens whose magnifying power multiplies diameters about forty times, it appears to be covered by minute polygonal fossæ, from $\frac{1}{100}$ to $\frac{1}{250}$ of an inch in width, surrounded by narrow sharp-edged borders, to which little leaf-like processes are sometimes attached. At the bases of each of these fossæ there are, at least during digestion, from six to ten minute apertures leading into tubes which pass vertically into the substance of the mucous membrane. A thin section of the membrane, made perpendicularly to its surface, shows that nearly its whole substance is composed of these tubes, which are minute cylindrical glands, opening on the surface in the fossæ just described, but closed below, and set compactly side by side in groups. They vary in length from one-fourth of a line to nearly a line, the longest being situated near the pylorus. Near their bases they measure about $\frac{1}{300}$ of an inch in diameter, and near their orifices about $\frac{1}{500}$. Their lower closed extremities sometimes seem (but only seem) a little convoluted or baccated. They lie in every part of the mucous membrane, but are largest and most densely set, so that they are actually in contact, near the pylorus; a few of them are branched, two or more tubules opening by a single orifice. The small blood-vessels pass vertically in the cellular tissue between the groups of tubules from the submucous tissue to the surface of the stomach, on which they form an angular network, marking out the borders of the shallow fossæ.

The walls of these little tubular glands are composed, near the surface of the stomach, of a fine structureless membrane, and, at the deeper part, of minute nucleated cells adhering by their edges. Their office seems to be the production of cells containing the fluid for digestion. In different parts of the stomach, and at different times, they vary in the nature of the substance which they contain; and it seems probable that these variations depend on whether the tubes are, or are not, engaged in producing digestive fluid. Those which are so occupied are completely filled with cells in different stages of development; those which are inactive are empty, and have their walls lined internally by epithelium, similar to that which invests the interior of the stomach. In the production of the cells containing the digestive fluid, small granules are first generated in the deeper part of each tubular gland: these, coalescing by twos or threes, form nuclei, on which the cells are developed according to the ordinary mode of formation of primary cells. [NUTRITION.] The cells are of an oval form, about $\frac{1}{2000}$ of an inch in length; and, as fast as they are produced, they are pushed towards the orifices of the tubes, from which, while digestion is going on, they are discharged in such numbers as to form, with a small quantity of fluid separated at the same time, the thick layer of mucus by which the whole interior of the stomach is lined, and by which the portions of food are invested. In the intervals between successive acts of digestion, it seems probable that the orifices of the tubules are closed by small portions of epithelium similar to that by which they are lined, and which are elevated and broken through for the discharge of the cells as soon as the active process commences.

During digestion there are also often found, just beneath the surface of the mucous membrane, around either the cardiac or pyloric orifice, and along the lesser arch of the stomach, a number of small closed sacculi, filled with an opaque white fluid containing cells, which, when their contents are matured, burst and discharge them into the interior of the stomach. But the exact office of these bodies (which have been generally described as the gastric follicles, or lenticular glands of the stomach) is not known; they are certainly not always present, but, probably, are produced rapidly while digestion is going on, and, having discharged their contents, are again rapidly absorbed.

The distinctive character of the fluid contained in the cells formed by the tubular gastric glands is, that it holds in solution a peculiar chemical principle, to which the name of Pepsin has been given, and which in conjunction with a small quantity of acetic or muriatic acid constitutes the true gastric juice or digestive fluid. It may be extracted from the mucous membrane of the stomach after death, and if a slightly acidulated solution of it be mixed with food, the latter will pass through the same changes as are produced by digestion in the living stomach or in the gastric fluid obtained during life, and will be at last converted into chyme. [DIGESTION.]

The simplest proceeding for observing this process of artificial digestion, is to macerate a stomach (if taken from a ruminant animal, it must be the fourth stomach) in about twice its weight of lukewarm water, to which about $\frac{1}{10}$th part or any sufficient quantity of muriatic or acetic acid has been added, to make it taste pretty strongly sour. The maceration having been continued for eight or ten hours at a temperature between 80° and 100° Fahrenheit, the liquor may be poured off, and will serve for all ordinary experiments. A purer digestive fluid is obtained by removing the mucous membrane from the middle portion of a pig's stomach (which contains the greatest number of active glands), washing it carefully, digesting it for a few hours in about six ounces of distilled water at a temperature of 90° Fahrenheit, and then again repeatedly washing it in cold water till it begins to be a little putrid. The liquor in which it has been macerated and washed must be filtered, and acetate of lead being added to it will be precipitated in combination with the pepsin. The precipitate should then be repeatedly washed, and a stream of sulphuretted hydrogen gas passed through the water in which it is kept suspended by constant stirring. By this means the lead is removed; and the fluid, being again filtered and evaporated to the thickness of syrup, must be mixed with absolute alcohol, which will precipitate the pepsin combined with a small quantity of acetic acid in white flocculi. These may be collected on a filter and dried in the air.

Slightly acidulated water, in which $\frac{1}{60000}$ part of its weight of pepsin thus prepared is dissolved, forms an active digestive fluid, and portions of meat, albumen, &c. are converted into chyme after a few hours immersion in it, at a temperature between 70° and 100° Fahr. This peculiar property, its power of coagulating milk, and its not being precipitated from its acid solutions by ferro-cyanide of potassium, are the chief qualities which distinguish pepsin from albumen; in all other chemical characters they closely agree.

The best method of exhibiting the action of an artificial digestive fluid is, to put small pieces of boiled white of egg, bread, meat, &c. into several chemical test-tubes; and to add to those in the first tube some solution of pepsin with acid, to those in the second some of the same solution without acid, to those in the third some water with the same proportion of acid, and to those in the fourth some water alone. After remaining for a few hours at the temperature already mentioned, the substances in the first tube alone will have under-

gone any material alteration. In about twenty-four hours, they will be nearly or completely dissolved, and will have lost many of their chemical properties; the albumen, for instance, being no longer coagulable, but resolved into osmazome, salivary matter, and some new substance, while the same materials in the other tubes will be still unchanged. In short, the changes that may be effected by this artificial fluid are exact repetitions of those described under DIGESTION as resulting from the gastric juice. To this article therefore we may again refer, only observing that all the facts of artificial digestion render it nearly certain that the similar process which takes place in the living body is not due to any vital property of the gastric fluid, but to its peculiar chemical condition; though in what this peculiarity consists, and whether the acid or the pepsin be the actual solvent principle, are questions at present altogether undecided.

The best works in which the subjects here considered may be further studied, are Sprott Boyd, *On the Structure of the Mucous Membrane of the Stomach*, in *Edinburgh Med. and Surg. Journal*, 1836; Purkinje, *Isis*, 1838, and Müller's *Archiv.*, 1838; Bischoff, *Ueber den Bau der Magenschleimhaut*, Müller's *Archiv.*, 1838; Krause, *ibid*, 1839, cxx.; Eberle, *Physiologie der Verdauung*; Schwann, Müller's *Archiv.*, 1836; Wasmann, *De Digestione*, and the *Physiological Systems of Müller and Wagner*.

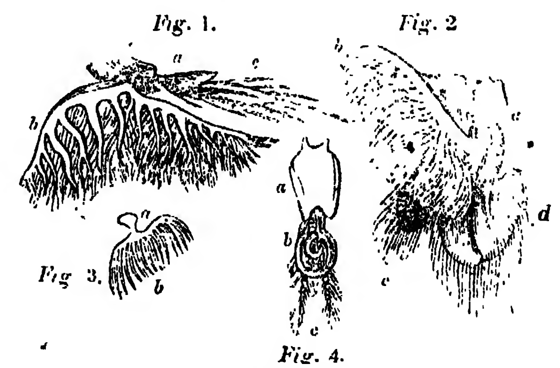
STOMAPODS. M. Milne Edwards comprises in the order *Stomapodes* all the podophthalmous crustaceans which are deprived of thoracic branchiæ lodged in internal cavities.

ORGANIZATION.

This division is entirely composed of swimming crustaceans, whose body is elongated, and whose general form often approaches closely to that of the macrourous decapods; but in those animals the concentration of the rings of the head and thorax is carried less far. In the greater part of the Stomapods the ophthalmic and antennular rings are not confounded with the rest of the head, and they even sometimes acquire a remarkable development. As in the other *Podophthalma*, there always exists a *carapace*, which is formed by the enlargement of the dorsal arch of the antennary or mandibular rings: but the dimensions of this buckler vary greatly. Sometimes it covers nearly the whole of the thorax, and only leaves exposed a portion of the last ring of that part of the body; sometimes, whilst it prolongs itself above the thoracic rings, it only adheres to those which are near the mouth, and leaves the others free and complete under its lower surface. In other cases it does not reach the four or five last rings of the thorax, which then resemble those of the abdomen. In form it varies too much for general description. The *thorax* is generally elongated, and entirely composed of segments moveable upon each other. Sometimes all the rings of this part of the body are united into a single piece. The conformation of the *abdomen* varies still more; this portion of the body presents in general nearly the same disposition as in the macrourous decapods, and terminates by a great caudal fin composed of appendages of the sixth ring and the following segment: but in some stomapods the abdomen is rudimentary. The disposition of the limbs is equally variable. The *eyes* are always carried on a first pair of moveable appendages, the length of which is often very considerable, and whose disposition is essentially the same as in the macrourous decapods. The first pair of *antennæ* are rather long, and terminate in two or three multiarticulate filaments; their peduncle is always cylindrical, and they can never be bent back under the front as in the brachyurous decapods. They are inserted below the eyes, near the median line, or externally to the base of those organs. The second pair of antennæ vary still more; their conformation however generally approaches that in the SHRIMPS. The basilary joint of their peduncle nearly always carries above a great ciliated blade, and they terminate by a long multiarticulate filament. In the greater part of the Stomapods they are inserted outside the first pair, nearly on the same transversal line. The distance which separates the mouth from these appendages is generally very considerable; and the carapace never recurves below, so as to form round that aperture a well determined frame serving to lodge the jaw-feet, as in the greater part of the decapods. In the majority the buccal apparatus is more simple than in the preceding order, and is only composed of an upper lip, a a pair of mandibles, a lower lip, two pairs of jaws, and a single pair of jaw-feet; these last organs are either altogether wanting, or are transformed into natatory feet, and nearly always the seven following pairs of members are all so formed as to constitute natatory or prehensile feet. It is also worthy of note, that in the stomapods the second pair of jaws never carry at their base a lamellar appendage analogous to the valvule, which, in the decapods, fulfils functions so important in the mechanism of respiration; and this modification of structure is a natural consequence of the absence of a respiratory cavity which includes the thoracic branchiæ, as in the preceding order.

There are generally seven or eight pairs of feet, often presenting the same mode of conformation. They are nearly always provided with an appendage, which may be considered as the analogue of a palp. There is often found also at the base of many of the anterior feet another soft and vesicular appendage, which has sometimes the form of a *galette*, and which represents the flagrum, an organ which, in the greater portion of the decapods, is lamellar and of a horny consistence; but which, in certain shrimps, presents a structure similar to that in the stomapods. Three of the last pairs, or a greater number, are always natatory; the first pair, or even the four first, are often prehensile; but they never terminate in a didactylous pincer, as in the decapods: they are subcheliform, that is to say, nothing more than a moveable claw which falls on the preceding joint. The greater part of these organs are approximated to the mouth, or even applied against it; a disposition which has been the cause of the appellation *Stomapods*. The abdominal members present nothing peculiar; their number is nearly always six pairs.

The *branchiæ* of the stomapods are always external, and present in general a more complicated structure than those of the decapods. Instead of being composed of lamellæ or simple filaments, they are framed of cylinders ranged in parallel order, giving origin to other smaller cylinders, which, in their turn, are equally fringed. Sometimes these ramose branchiæ are fixed at the base of the thoracic feet, and suspended under the thorax: but in general they spring from the basilary joint of the abdominal false feet: in some of the order they are reduced to a rudimentary state; in others nothing is to be seen which can be considered as a special organ of respiration; and, in such cases, there is every reason to believe that this function is exercised by the general surface of the teguments.



Branchiæ of Stomapods.

1, one of the branchiæ of *Thysanopoda* a, base of the posterior foot; c, palp; b, branchiæ. 2, a branchia of *Squilla* a, base of the false foot; b, branchia; c, d, the two terminal branches of the false foot. 3, a, one of the branches of this ramose branchia; b, the branchlets (ramuscules). 4, one of the abdominal false feet of *Cynthia*. a, basilary joint; b, branchia; c, lamellar appendages.

The apparatus of *circulation* differs much from that of the decapods. In the *Squillæ*, the only stomapods which have been anatomically examined, the heart, instead of being nearly quadrilateral, and situated towards the middle of the thorax, has the form of a long cylindrical vessel, which extends throughout the length of the abdomen: the arteries which spring from this tubular heart are distributed in a peculiar manner; and the principal venous sinuses, instead of being situated on the thorax, occupy the abdomen.

The *stomach* of some stomapods presents vestiges of the solid framework, which, in the decapods, is armed with teeth serving to bruise the aliments in the interior of the digestive cavity; but in general nothing similar is to be found. The structure of the *liver* also varies: and in those species in which the organs of *generation* have been examined, remarkable peculiarities have been observed in their disposition. The *nervous system* in this order presents also

modifications which have not been found in the decapods; and its disposition varies too much to enable M. Milne Edwards to say anything general of it.

Such is the organization of the stomapods, as stated by M. Milne Edwards, an order less numerous than the decapods, but comprising crustaceans which differ much from each other, both in general form and in the particular structure of their principal organs.

Systematic Arrangement and Natural History.

The same excellent author, and we can follow none more deeply versed in the subject, divides the stomapods, after the example of Latreille, into three families:—the *Caridoïdes*, the *Bicuirassés*, and the *Unicuirassés*.

1. *Caridoid Stomapods.*

The crustaceans arranged by M. Milne Edwards under this family bear a close resemblance in their general form, he observes, to the family of *Salicoques* or Shrimps; and indeed till lately their position had been in the order *Decapoda*, where they constituted a small and peculiar family under the name of Schizopoda; but the anatomical investigations made by M. Milne Edwards with respect to the organs of respiration in these animals, and the discovery of new species which establish a passage between the former and Phyllosoma, led him to propose new limits between the decapods and stomapods, and to place the schizopods in the second of those groups. This innovation, he remarks, had been adopted by Latreille in his last work (*Cours d'Entomologie*): and that scientific naturalist gave to the new division of the order *Stomapods*, established for the reception of those *Podophthalmous Crustaceans* which are deprived of internal thoracic branchiæ, but are similar to certain *Salicoques* in their external form, the name of *Caridoids* from that resemblance.

Family Character.—Body thick, and slightly compressed laterally; head confounded with the thorax, and all the rings of the last-named part (with the exception, sometimes, of the last, or of the two last) completely united together and soldered above with the carapace. *Abdomen* considerably developed, and terminating by a great fin composed of five laminæ or blades, disposed in a fan-shape, as in the *Macrourous Decapods*. The *carapace* descends on each side against the base of the feet; covers the whole, or nearly the whole, of the thorax, as well as the head; and presents only a rudimentary rostrum in front: there is no moveable plate in place of this frontal prolongation, as in *Squilla*, and the ophthalmic ring is in general very short and naked. The disposition of the eyes, of the antennæ, and of the pieces of the mouth, varies. The thoracic plates are all slender, natatory, and resemble each other; but their number varies much. The *abdomen* is composed, as ordinarily, of seven rings, the five first of which carry natatory false feet, whilst the seventh forms, with the appendages of the sixth segment, the caudal fin: these last appendages consist each of a small very short basilary joint, and of two great terminal plates disposed as in the macrourous decapods. Finally, the conformation of the respiratory apparatus varies: sometimes the branchiæ do not exist; sometimes vestiges of them are found at the abdominal false feet; and sometimes they are, on the contrary, very much developed, and suspended under the thorax. (M. E.)

M. Milne Edwards divides the *Caridoïds* into two small tribes, the *Mysians* and the *Luciferians*.

1st tribe. Mysians.

This tribe resembles the *Salicoques* so closely, that till lately the species forming it had been arranged under the *Macrourous Decapods*, where they constituted the family designated *Schizopods*.

Character of the Tribe.—*Carapace* extending to the base of the ocular peduncles, and presenting in general in the middle of the front a rudimentary rostrum. *Antennæ* inserted on two lines and formed as in the shrimps, excepting only that the lamellar appendage of the second pair is less. *Mouth* situated very near the base of these last, and composed essentially of a *labrum*, a pair of mandibles furnished with a palpiform stem, a lower lip, and two pairs of lamellar jaws: sometimes the whole suite of limbs, which succeed to those appendages, belong to the apparatus of locomotion; but, in other cases, one or even two pairs of these organs constitute jaw-feet, without their form always differing much from that of the thoracic feet. These feet each present two branches which are well developed and carried on a very short basilary joint, so that they seem to be bifid from their base. *Abdomen* of moderate length; *false feet* fixed to its first rings, sometimes rudimentary. (M. E.)

Under this family M. Milne Edwards arranges the genera *Mysis*, *Cynthia*, and *Thysanopoda*.

Mysis.

Generic Character.—*Body* narrow, elongated. *Carapace* covering the anterior extremity of the trunk as well as the greater part of the thorax, and bent down on each side so as to apply itself against the base of the feet. It is free laterally, and does not adhere to the last rings of the thorax; anteriorly it is narrowed considerably, and terminates by a small flattened and very short rostrum; its posterior border is deeply notched. *Eyes* large, short, and with their base hidden under the anterior part of the carapace. *Internal Antennæ* inserted below the eyes, near the median line; peduncle of the same form as in the shrimps, and carrying at its extremity two multiarticulate and rather long filaments. The *second pair of antennæ* inserted below the preceding, and, equally, directed forwards: the first joint of their peduncle gives origin to a very elongated lamellar appendage, which is ciliated on the internal border that covers the base of those organs, as in the shrimps. The two succeeding joints of the peduncle are slender and cylindrical, and the terminal filament is filiform, multiarticulate, and longer than the upper antennæ. *Mouth* very much approximated to the base of the antennæ, and presenting, as ordinarily, an upper transversal lip succeeded by a pair of mandibles, a lower lip, two pairs of jaws, and a certain number of jaw-feet. *Mandibles* toothed on their internal edge and carrying a highly developed palpiform stem extending forward to a considerable length. The first pair of *jaws* each composed of two small flattened blades or flattened lobes ciliated on the internal border. Second pair of jaws larger and much resembling those of *Squilla*, without being however so narrow. They are lamellar and divided on the external side into four lobes, by more or less deep incisions; the last of these lobes is formed by the terminal joint, and the first belongs also to a distinct basilary joint; but the two median lobes are confounded together to their base, and would seem to belong to a single joint, the external border of which is dilated, rounded, and ciliated; the internal border of these organs is equally furnished with hairs. The *jaw-feet* are two in number; but differ very little from the true feet. The first pair are short, rather long at their base, and composed of three branches; the internal is pediform, divided into five joints, furnished with hairs, and bent back internally before the mouth; the median branch or palp is more elongated, and presents a very large basilary joint succeeded by a kind of ciliated strap (lanière) on each side, and composed of a very great number of small joints. Finally, the external branch or flabelliform appendage is represented by a semimembranous blade which is directed upwards and lodged between the carapace and the sides. The second pair of jaw-feet have the same form, but their internal branch is more elongated and they want the flabelliform appendage; as in the preceding, the last joint of their internal branch is lamellar, wide, short, and rounded at the end. The six pairs of thoracic feet, which succeed the buccal apparatus, and which are composed of members corresponding to external jaw feet and to the five pairs of ambulatory feet in the decapods, are all slender and divided into two branches; their length increases progressively from before backwards, and they are all formed for swimming only. The internal branch presents nearly the ordinary form, but terminates in an unguiform tarsus, which is hardly visible, and precedes a styliform joint, which seems multiarticulate, and is ciliated in its two borders. The external branch or palp is nearly as long as the internal branch, and has the same form as that of the jaw-feet. The four first pairs of feet carry no external branch or flabelliform appendage, whilst those of the two last are provided with it. In the males, those appendages are rudimentary, but in the females they acquire an extreme development and constitute great semicorneous blades bent in under the sternum, so as to form a species of pouch destined for the lodgment of the eggs, and of the young during the early part of their life; a disposition very analogous to that observable in the Isopoda. The two last rings of the thorax are entire, more or less completely exposed, and resembling those of the *abdomen*, which is elongated, nearly cylindrical, and gradually narrowed from before backwards: the dorsal portion of these last rings is not prolonged laterally so as to encase the base

of the false feet, as in the majority of the shrimps: it terminates by a great caudal fin, composed of five blades disposed in a fan-shape, exactly as in the macrourous decapods. Finally, the five first pairs of feet are rudimentary, and are only composed each of a small ciliated blade in the female: but in the male may be distinguished a peduncle and a terminal blade; the first and last pairs acquire sometimes a considerable development.

There is no vestige of branchiæ, either at the vault of the sides or at the base of the feet, or at the lower surface of the abdomen, and the only appendage which would seem to be modified in its structure so as to become more proper than the rest of the body to fulfil the functions of an organ of respiration, is the flagrum of the first pair of jaw-feet, whose disposition, for the rest, is nearly the same as that which may be remarked in a great number of crustaceans provided with branchiæ. Some authors give the name of branchiæ to the basilary joint of the external branch or palp of the thoracic feet, but without supporting this determination by any argument which might lead one to adopt it.'

Such is M. Milne Edwards's luminous description of this most interesting genus of crustaceans; but we must not overlook the distinguished labours of Mr. John V. Thompson, so well known for his accurate and original observations relating to the *crustacea* and other marine animals of the Irish seas. To the last-named zoologist, more than perhaps to any other, we owe our knowledge of the organization and habits of these *opossum shrimps*, as they have been named from the pouch or personal nest, above described, provided for the reception of their eggs and young. He closely examined the circulation of these animals, and has shown that their heart is elongated and occupies the posterior part of the thorax. Anteriorly it gives origin to a slender vessel which has its course above the stomach, and is continued backwards with a large abdominal artery; on each side, it receives a vessel which appears to be a branchio-cardiac trunk. The pulsations of the heart are so rapid that they resemble vibrations, and the blood is so transparent and so little coloured, that its movement is only to be distinguished by means of the globules floating therein. Mr. Thompson states that on observing with attention the termination of the posterior aorta at the end of the tail, a periodical action may be noticed, as of the opening and closing of a valvular opening on each side, accompanied each time by the filling of the corresponding end of a vessel of considerable size, lying on each side of the intestinal canal; and that these vessels or veins propel the blood towards the heart by successive contractions of their muscular fibres, and seem to be lost at length in a great sinus or auricle, lying beneath the heart. But Mr. Thompson adds that it remains to be ascertained by dissection, whether this is the case or not; he thinks however that there can scarcely be a doubt that the two large veins constitute the *venæ portæ*, and ultimately send their blood to the branchia.

The same diligent observer thus describes the *valvular pouch*:—'Attached to the base of each of the inner divisions of the two posterior pairs of feet in the *female*, is a large concave scale, strongly pectinate in front, of which the posterior is the outermost, largest, and most concave, lapping considerably over the anterior scale, so as to admit of a considerable extension of the size of the pouch which they form by meeting each other in front, in order to accommodate its capacity to the growth of the ova and young brood. In the *male*, in place of the valvular pouch of the female, we perceive attached to the inner part of the last pair of feet only, a single small hollow scale on each side, ciliate in front, and provided with a marginal row of slender hooks at the apex: these are probably an appendage of the male organs, which have a similar situation in the shrimps.'

Within this pouch in the female, the eggs, or rather embryos, Mr. Thompson informs us, are received when excluded from the ovarium, and enveloped in a mucous or subgelatinous secretion, and gradually developed without any visible attachment to the parent. 'The ova when first received into the pouch are considerably more advanced than those of the shrimps, crabs, &c. on their first expulsion, and by no means so numerous, a circumstance more than compensated by the rapidity with which one brood succeeds another during the whole of the spring and summer months. The number of broods produced by one individual, as well as the time occupied in their evolution, have not been determined; but the changes which the embryo undergoes in configuration are sufficiently obvious; in the present instance, these cannot be considered as metamorphoses, but simply a gradual development of parts; hence the *Schizopoda* may be regarded as one exception to the crustaceans undergoing transformations, another character by which they are separable from the true shrimps, &c. The first change which is perceptible in the ova after their reception into the external pouch, is a slight elongation at one end, and the appearance of two short members on each side; this elongation, which proves to be the tail, increasing in length, shortly after becomes forked at the end, accompanied by a proportional growth in the four lateral members, and which are the rudiments of two pair of antennæ in the perfect animal; the embryo going on thus with a progressional development from day to day, begins to assume a more complete form, and an approximation to that of the parent, in which stages the divisions of the abdomen, the tail, the pedunculate eyes, and the various members are sufficiently distinct; a still more close resemblance to the perfect animal is attained before the young are finally excluded, which is effected by the parent spreading open the valves of its pouch, when the whole brood emerge at once into the ambient element, and, in most of the species, continue associated with the community from which they sprang: the slight differences which they now present (and which are necessary to be known in order to preclude the possibility of their being mistaken for individuals of a different species) affect only the inner rows of feet, the subabdominal fins, the outer antennæ, and the tail; the first of these, in place of the multarticulate termination, have but one or two short joints and a curved claw superadded to the end of the tibiæ, and hence this division of the limb is shorter in proportion; the subabdominal fins consist only of a linear joint surmounted by a few bristly hairs; the outer antennæ differ in no other respect than in the ciliated scale which is attached to their base being shorter and less developed, as is also the brush of hair in the males; the three intermediate scales of the tail are proportionally shorter, but yet present the character peculiar to the species in their form, indentations, and appendages, so as to testify the acuteness of Dr. Leach in having fixed upon this part to distinguish the species from each other. What is further remarkable in the embryos is the way in which they are arranged within the pouch from the moment they assume an elongated form; their heads being towards the breast of the mother, with the curvature of the tail part suited to that of the outline of the pouch, and the large size and blackness of their eyes.'

The different stages of development, &c. are illustrated by Mr. Thompson, in his 'Zoological Researches,' the work in which he gives the above description, and which is most valuable for the insight afforded to the naturalist into some of the most curious and hitherto obscure phenomena manifested by the crustaceans generally. The student will, no doubt, be led to compare the development of the young opossum shrimps with that of the quadrupedal MARSUPIALIA.

Geographical Distribution of the Genus.—The species swim freely in the sea in numerous troops, and are particularly abundant in the north, where, according to Otho Fabricius, they constitute a principal portion of the food of the whale-bone whales (*Balænæ*). Captain James Ross, R.N., states that *Mysis flexuosus* (*Cancer flexuosus*, Müller), though but sparingly found in the seas of Europe, inhabits some parts of the Arctic ocean in amazing numbers, and constitutes the principal food of the prodigious shoals of salmon that resort thither in the months of July and August, and upon which the inhabitants of BOOTHIA depend, in great measure, for their winter store of provisions. He further observes that it is also the chief food of the whale, by which such a prodigious quantity of fat is produced in the body of that immense animal. Captain Ross adds that during the summer these crustaceans assemble in vast myriads at the mouths of rivers, but in the winter are more generally distributed along the whole line of coast, and, together with the *Argonauta Arctica* (*Clio helicina* of Phipps and Gmelin—HYALÆIDÆ, vol. xii., p. 372), are to be seen in every crack that opens with the tide, even at the coldest period of the year. The natives call this crustacean *[illegible]kak*. (*Appendix to the Second Voyage of Captain Sir John Ross.*)

M. Milne Edwards divides the genus *Mysis* into the following sections:—

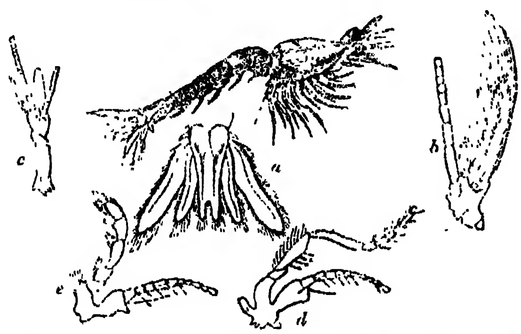
1. *Species which have the middle blade of the caudal fin bifurcated*

Example, *Mysis spinulosus*, Leach.

Description.—Rostrum depressed and triangular, and not more than the third of the length of the ocular peduncles. Carapace extending nearly on the penultimate thoracic ring. Peduncle of the internal antennæ stout and very short. Lamellar appendage of the external antennæ narrow, of the same length (width?) to the end, and ciliated within and at the end. Median blade of the caudal fin furnished with spines on its lateral borders, and deeply notched at the end: internal blades of the lateral appendages narrowing gradually towards the end, and the external blades very obtuse. Length about 10 lines; colour brownish, with a small star in the middle of each of the rings of the abdomen.

Locality.—The British Channel and the coasts of La Vendée. (M. E.)

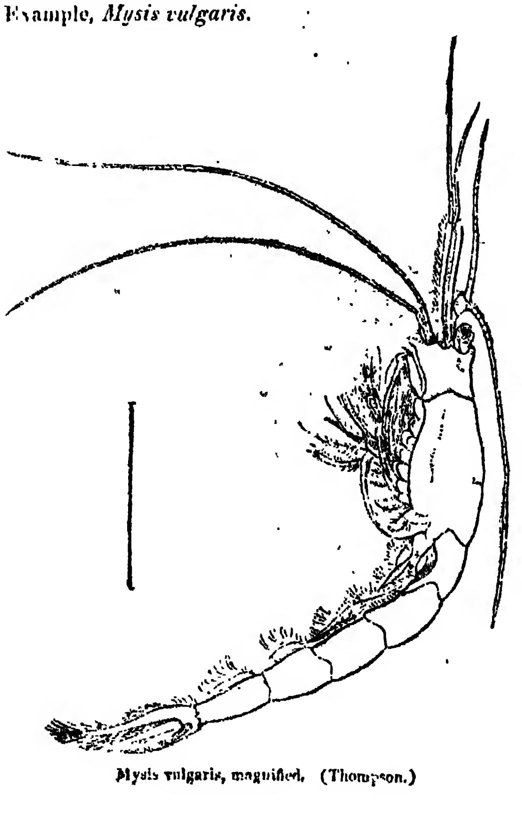
M. Milne Edwards gives the following as synonyms of this species:—*Praunus flexuosus*, Leach; *Mysis Leachii*, Thompson (*Zool. Res*). Leach's *Mysis Fabricii* does not appear to M. Milne Edwards to differ notably from *M. spinulosus*, especially if one may judge of it from the figure given of it by Desmarest; but at the same time, he observes, one ought not to forget that Latreille has represented, in the atlas of the 'Encyclopédie,' the lamellar appendage of the external antennæ as being ciliated externally as well as internally; a disposition which, if it really exist, would be characteristic.



Mysis Fabricii magnified. *a*, The last ring of its body, or its terminal fin; *b*, base of a lateral antenna; *c*, base of an intermediate antenna, *d*, one of the second pair of jaw feet; *e* one of the first four. These parts highly magnified. (Desm.)

2. *Species which have the median blade of the caudal fin entire at the end.*

Example, *Mysis vulgaris.*



Mysis vulgaris, magnified. (Thompson.)

Description.—Rostrum moderate; internal antennæ short, having their peduncle formed as in *M. spinulosus;* lamellar appendage of the external antennæ as in *Mysis longicornis;* lateral and middle fins of the caudal fin diminishing gradually in width from their base to their extremity; length about an inch; colour greyish.

Locality, Habits, &c.—Common on the Irish coast. Abounding in the Lee, even up to Cork, from the early part of spring to the approach of winter, according to Mr. Thompson, who states that during the still period of the tide at low-water, they repose upon the mud and stones at the bottom of the river, and, as the tide rises, may be observed forming a wide belt within its margin, the youngest swimming nearest to the shore, the oldest farther out and in deeper water. They appear, he adds, to be mostly females, the males being few in proportion, and they swim in a horizontal position, contributing towards the food of various young fish, from which they frequently escape by springing up out of the water.

Cynthia. (Thompson.)*

Generic Character.—Body slender and of the same form as in *Mysis;* but the carapace of *Cynthia* is smaller and terminates anteriorly by a small rostral prolongation; behind it a certain number of thoracic rings are exposed. *Eyes* stout and short, of moderate length. First pair of *antennæ* excavated at their base to make room for the eyes; their peduncle is stout, and they have two terminal filaments. The second pair of antennæ are inserted below the preceding, as in *Mysis*, but they are much smaller; the lamellar appendage which covers their base is shorter than the peduncle of the upper antennæ. Conformation of the buccal apparatus nearly the same as in *Mysis:* palpiform stem of the mandibles very large; second pair of jaws lamellar and divided on the internal side into many lobes. The eight pairs of limbs which succeed the jaws, ought, according to Mr. Thompson, to be considered as natatory feet; but M. Milne Edwards does not agree in that opinion, and the latter believes that the first pair of these organs also belong to the buccal apparatus, and constitute jaw-feet. In fact, observes M. Milne Edwards, those appendages, although more elongated than in *Mysis*, are bent back just in the same way as in that genus below the jaws, and their internal branch terminates by an enlarged joint, which is proper for retaining the aliments during mastication, whilst the feet terminate in a small hooked nail. The middle branch or palp of those jaw-feet is formed as in *Mysis*, but the flagrum or external branch, which, in the last-named genus constitutes a great membranous blade, appears to be completely wanting. The first pair of thoracic limbs differ also a little from the six last pairs of feet; they are more enlarged, and terminate by a lamellar joint, whose borders are ciliated; but nevertheless, by reason of their length and their position, they ought, remarks M. Milne Edwards, to be considered as assisting in locomotion, and they furnish us with a new example of the gradual manner in which the passage is effected between animals in which the same organs are modified in their structure to serve different purposes. In *Cynthia* the number of thoracic feet amounts to seven pairs, and in their structure and functions they do not differ remarkably from the same organs in *Mysis;* their two branches are equally well developed, only the penultimate joint of the internal stem is stouter, does not narrow towards its end, is not ringed so as to appear multiarticulate, and the terminal nail is larger. M. Milne Edwards observes that the conformation of the appendages which probably exist on the posterior feet of the females, and which to all appearance ought to fulfil the same functions as in *Mysis*, is not known; in the males may be remarked, at the base of the posterior feet, a small blade which represents the flabelliform appendage. *Abdomen* formed as in *Mysis*, excepting that the false feet fixed to the five first rings are very well developed, and of the same form as in the shrimps; each of these limbs is composed of a very stout peduncular joint and of two long blades, which are multiarticulate and ciliated on their edges. *Branchial appendages* of a particular form are attached to the extremity of the peduncles of the false feet behind the terminal blades; these appendages consist of a membranous cylinder bifurcated near its base, each of whose branches is rolled upon itself.

Example, *Cynthia Thompsonii.*

Description.—Rostrum very short; carapace extending to the last ring of the thorax, and but little narrowed for-

* Appropriated by Savigny to certain *Ascidians.* [CYNTHIA.]

wards; peduncle of the internal antennæ of the length of the lamellar appendage of the external antennæ, and having the last joint furnished within with a small piliferous scale; median blade of the caudal fin long, truncated at the end, and furnished laterally with spines; external blades shorter than the middle ones, and only having hairs or spines on their internal border and at their extremity; middle blades furnished with spines on their internal border; length about four lines.

Localities.—The Atlantic Ocean, between Madeira and the Antilles. (M. E.)

N. B. M. Milne Edwards observes that the *Cynthiæ* are of small dimensions, and seem to have the same habits as the species of *Mysis*, with which last they are frequently found. He further remarks that the males only have been as yet observed, and that possibly, when both sexes are known, it may be necessary to modify the characters assigned to this genus.

Thysanopoda. (M. Edwards.)

M. Milne Edwards states that these crustaceans resemble the shrimps greatly in the general form of their body, but are distinguished from the Decapods, as well as the other Stomapods, by the disposition of their respiratory apparatus. The branchiæ, he tells us, are each composed of a kind of stem, whence spring, at a right angle, a certain number of lateral branchiæ, whose inferior border is in its turn furnished with a series of long cylindrical filaments. This mode of organization is, he observes, very analogous to what may be seen in the *Squillæ*, but the branchiæ (see the cut, p. 77), instead of being inserted in the abdomen, as in the last-named crustaceans, occupy the thoracic part of the body, as in the Decapods. Nevertheless they are not enclosed in particular cavities, as in that order; they are situated on the exterior of the body, and float freely in the water with which the animal is bathed. They are fixed at the base of the eight pairs of thoracic feet, and their length increases from before backwards.

Generic Character.—External form resembling that of *Mysis*. *Body* presenting the same divisions as in the macrourous decapods. *Carapace*, which covers the head, hiding also the whole of the thorax. *Abdomen*, whose length much exceeds that of the cephalo-thorax, extended backwards, and composed of seven segments, the three median of which present on their posterior and superior borders a small spine, directed backwards. Carapace terminated anteriorly by a small pointed *rostrum*, which does not reach to the extremity of the eyes, whose peduncles are stout and short. *Antennæ* four in number, inserted on two lines, and nearly equal in length: the upper with a peduncle recurved at its base, to receive the eyes, and composed of three cylindroid joints: they are terminated by two rather long filiform stems. Base of the lower antennæ covered by a long lamellar scale, the extremity and internal border of which are ciliated, the terminal stem presenting nothing remarkable. *Mouth* situated at a small distance from the point of the insertion of the lower antennæ, and surrounded, as ordinarily, with a rather stout labrum, a bifid tonguelet, and a pair of *mandibles*, which are armed on their internal border with some pointed teeth, and carry a short and flattened palp, divided into three joints. Two pairs of *jaws* are applied on the mandibles and tonguelet. The first pair offer nothing remarkable. The second are composed of three lamellar joints, the two first of which are bilobated on the internal side: no trace is here to be seen of the great foliaceous appendage which always exists on the external side of these organs in the decapods, and which assists in the mechanism of respiration: their form and structure are absolutely the same as in *Squilla*, *Alima*, &c. The eight pairs of limbs which succeed the jaws, and which correspond both with the jaw-feet and ambulatory feet of the decapod crustaceans, have here all the same form and the same uses: not one of them enters into the composition of the buccal apparatus; but all serve for locomotion. These *feet*, with the exception of the last pair, are long, slender, and bifid, as in *Mysis*. Their basilary joint, stout and short, carries within a long stem, furnished with numerous hairs, and externally a palp or middle branch, composed of two pieces, the last of which is delicate, lamellar, and ciliated on the borders. The length of these natatory feet increases a little from the first to the fifth pair, and then diminishes; those of the eighth and last want an internal stem, and consist only of the external branch or palp. The five first segments of the abdomen support also small natatory feet, formed of a cylindrical peduncle, carrying two elongated and ciliated blades on the borders, the internal of which, shorter than the external, carries in its turn a small cylindrical appendage. The limbs of the sixth and seventh rings of the abdomen become lamellar, constituting a fan-shaped fin, the median narrow and pointed piece of which terminates in three sharp spines; and the lateral ones, equally narrow, are furnished on the borders with long hairs. (M. E.)

Example, *Thysanopoda tricuspida*, the only species known. Length about 15 lines. *Locality.*—Found far at sea, in the Atlantic Ocean, by M. Reynaud.

M. Milne Edwards thinks that the genus *Podopsis**, or *Hammer-headed Shrimp* of Thompson, may belong to this family; but he observes, that it is too imperfectly known to warrant the assignment of precise characters to it. This crustacean, which was found in the Atlantic Ocean, and is phosphorescent, is figured and described in the interesting *Zoological Researches* above quoted.

2nd Tribe. Luciferians.

M. Milne Edwards observes that the genus *Lucifer*, established by Mr. Thompson, is one of the most singular known; and as it does not, without difficulty, admit of arrangement in any of the tribes already established, M. Milne Edwards, though he remarks that its history is still very incomplete, is of opinion that it should be taken as the type of a particular tribe, to which he thinks certain magnified figures of crustaceans in the atlas of Krusenstern's 'Voyage' ought to be referred.

Mr. Thompson states that this singular and extraordinary type, like *Noctiluca*, also described and figured by him in his *Zoological Researches*, conduces to the sparkling appearance of the sea in the tropical regions, and the individual figured by him (see cut) was taken in the Atlantic, in 11° 56′ N. lat. and 32° 55′ W. long.

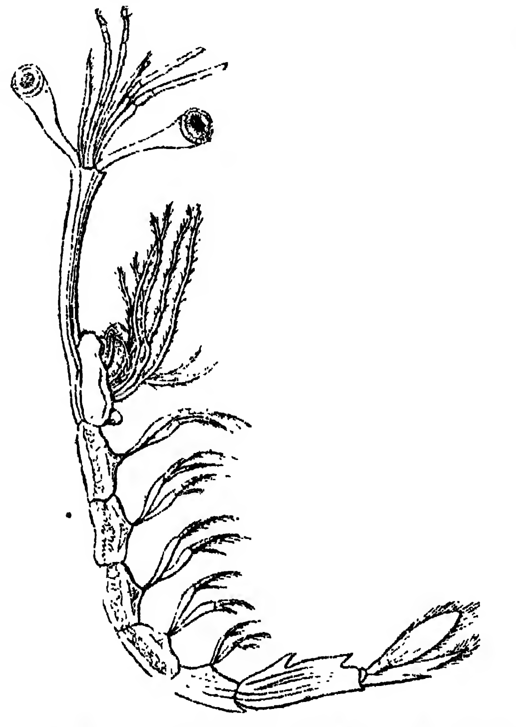
M. Milne Edwards observes, that one of the most remarkable traits of this crustacean is the excessive length of the anterior portion of the head; the extreme brevity of the part of the body occupied by the mouth, and constituting the thorax; and the great development of the abdomen.

Generic Character.—M. Milne Edwards, whose description is more full than that of Mr. Thompson, and who records two species, *Lucifer Reynaudii*, and *L. Typus*, states that the general form of the body is nearly linear. *Eyes* and *Antennæ* carried at the extremity of a long, slender, and cylindrical prolongation, which is much longer than all the rest of the cephalo-thoracic portion of the body, and seems to be formed principally by the antennary ring. A small *carapace* covers the whole of the posterior portion of the cephalo-thorax, and presents nearly the same form as in *Mysis*. The *Eyes* are large, and carried at the extremity of very long peduncles. The first pair of *antennæ* are slender, short, and terminated by a multiarticulate, rudimentary stemlet; the second pair are inserted below, close to the preceding, and are equally slender: near their base is seen a small lamellar appendage, but their mode of termination is unknown. *Mouth* projecting and situated behind the base of the prolongation, which carries the eyes, &c. Here are found *mandibles*, which are strong and toothed, but deprived of a palpiform stem; two pairs of *jaws*, each bearing two blades; two pairs of short and lamellar *jaw-feet*, and one pair of external *jaw-feet*, which are long, pediform, and bent back against the mouth. In succession to these organs may be seen four pairs of long and slender natatory feet, which gradually lessen toward the end, and are furnished with scattered hairs. M. Milne Edwards could find no vestige of a palp or a flagrum at the base of these feet, nor could he perceive any trace of the existence of the last pair of feet, which are here wanting to complete the normal number of the thoracic feet; but he observes that in the figure given by Mr. Thompson, there is at the posterior part of the thorax a tubercle, which is, perhaps, a vestige of those appendages. The *abdomen* is very narrow, and is composed, as ordinarily, of seven rings, but acquires a development entirely abnormal; for each of these segments is at least as long as the whole cephalo-thoracic portion of the body, where the mouth and feet are situated. The five first rings are nearly equal, and each carry a pair of very long false feet, composed of a basilary, cylindrical joint, and of one or two natatory, elongated, multiarticulate, and ciliated blades; in individuals which

* Previously used for a supposed genus of *Conchifera*. [Spondylidæ, vol. xxii, p. 371.]

M. Milne Edwards presumes to be males, the first pair of false feet present towards the middle of their basilary joint a fleshy appendage of odd shape (forme bizarre). The sixth ring is compressed, very long, and toothed below. The abdomen is terminated by a caudal fin, composed, as ordinarily, of five blades disposed in a fan-shape. M. Milne Edwards did not find any vestige of thoracic branchiæ.

Example, *Lucifer Typus*. The same author states that this species differs from *Lucifer Reynaudii* (which was found in the Indian Ocean by M. Reynaud) in the form of the median piece of the caudal fin, which is lamellar, and without any notch below, in the more considerable length of the middle blades, and in the apparent absence of a separation between the carapace and oculiferous prolongation.



Lucifer Typus, Long-headed Shrimp, magnified, and of its natural size. (Thompson.)

The crustaceans numbered 9 and 10 in the atlas of Krusenstern's 'Voyage' are those which, according to M. Milne Edwards, belong to this genus.

II. *Bicuirassed Stomapods*. [PHYLLOSOMA.]

III. *Unicuirassed Stomapods*.

M. Milne Edwards remarks, that the crustaceans of this family are provided with a sufficiently large carapace, but that they nevertheless approach the EDRIOPHTHALMA in the conformation of the thorax, for the greater number of the rings of this middle portion of the body are complete, moveable, and naked, or simply covered by the dorsal buckler without any adhesion to it. The independence of the first segments of the body is carried even farther, he observes, in these crustaceans than in any other, for in the greater part of them, not only the ophthalmic ring, but also the antennular ring remains free, and in some there is a transversal piece at the base of the second pair of antennæ, which seems to be the representative of the lower arch of the third cephalic ring, and not soldered, as ordinarily, with the succeeding ring, of which the carapace is an appendix. Frequently all the thoracic and cephalic rings situated behind this last are equally distinct from each other and more or less moveable, but, with the exception of the four last, they are incomplete above, and represented only by their sternal arch. The abdomen is always very well developed, and is composed of seven moveable segments, the last of which constitutes a very large caudal blade. The *eyes* are stout and convex (*renflés*) towards the end; the first pair of antennæ are inserted below and behind their peduncle, and are composed of a cylindrical peduncle formed of three joints and terminated by three filaments, which are ordinarily multiarticulate. The second pair of antennæ are inserted behind and outside the preceding, and are provided with a great lamellar appendage fixed on a stout and cylindrical joint, at the extremity of the first joint of their peduncle, which also carries in front a filament which is, ordinarily, multiarticulate. The *mouth* is rather distant from the antennæ, and carried on a nearly triangular eminence, the base of which corresponds with the insertion of the prehensile feet. The upper lip is large, projecting, and semicircular. The *mandibles* are directed downwards and terminate by two toothed branches, one of which ascends in the back part of the mouth, towards the stomach; the palpiform stem which carries these organs is small and sometimes null. The lower lip is large and partially covers the extremity of the mandibles. The jaws are very small and applied exactly against the mouth; the first pair terminate by a kind of hook directed inwards, and armed with spines along the internal border of their second joint; there is also a small rudimentary palpiform appendage. The second pair of jaws are lamellar, nearly triangular, and composed of four or five joints placed end to end; nothing resembling a flabelliform appendage is to be seen. The members which belong to the seventh cephalic ring, and which, ordinarily, constitute the anterior *jaw-feet*, do not seem to belong to the buccal apparatus; they are very much elongated and form a pair of slender feet, generally enlarged towards the end, the uses of which are not known. The thoracic limbs of the first pair, which are the analogues of the second jaw-feet of the Decapods and of the anterior feet of the Edriophthalms, are largely developed and constitute great raptorial feet (*ravisseuses*), the last joint of which bends back as a long claw along the internal border of the preceding joint, and forms, after a fashion, a kind of pincer which the animal uses either for defence or the seizure of its prey. The three succeeding pairs of feet are much smaller, and in some sort brought forwards so as, ordinarily, to occupy a curved transversal line, and place themselves between the base of the raptorial feet; they are, in general, applied upon the mouth, and appear to serve only for the prehension of the aliments; they all terminate in a kind of oval hand, armed with a moveable claw, disposed so as to bend itself back against its internal border. These five pairs of limbs carry at their base, on the external side, a membranous vesicular appendage, flattened into the form of a disk and pediculated, which is the analogue of the flagrum, and which, according to some authors, may be a respiratory organ. The three last pairs of thoracic feet are rather distant from each other and directed downwards; they are slender, cylindrical, and nearly always furnished with a styliform appendage which springs at the extremity of their second joint. There are six pairs of abdominal limbs; the five first pairs are formed nearly as in the macrourous decapods, except that their peduncle is much wider, and that, in general, they give insertion to the branchiæ. The appendages of the sixth abdominal ring concur to form the caudal fin; they are directed outwards and terminated by two ciliated blades, between which is a great lamellar prolongation of the basilary joint; the external branch of these false feet is, ordinarily, composed of two joints. There is sometimes on the posterior border of the last segment of the abdomen a pair of moveable spines which may be considered as vestiges of a seventh pair of abdominal limbs. *Branchiæ* ramose, and composed of a great number of small cylinders, carried on stemlets, which, in their turn, spring from a stouter stem (see cut, p. 77); sometimes these organs are completely wanting or do not exist except in the state of vestiges, but, in general, they are highly developed. They are suspended under the abdomen, at the base of the external blade of the five first pairs of false feet, and float freely in the water.

M. Milne Edwards divides this family into two small tribes, *Ericthians* and *Squillians*.

1st Tribe. Ericthians. [ERICHTHUS.]

2nd Tribe. Squillians.

Corresponding with the genus *Squilla* of Fabricius, and the majority of authors, this tribe comprehends, according to M. Milne Edwards, the genera *Squilla* (containing the *Squillæ*, properly so called), *Gonodactylus*, and *Coronis* of Latreille. All these crustaceans have, observes M. Edwards, the greatest resemblance to each other, and the differences upon which these genera are established have not perhaps as much importance as was once thought.

The *Squillians*, says the author last quoted, are, of all the podophthalmous crustaceans, those in which the various constituent rings of the body are the most equally developed and the most independent of each other. With the exception of those which immediately surround the mouth, all these rings are more or less moveable on each other, and the greater part are complete. The *carapace* neither covers the two first rings of the head nor the four last rings of the thorax, and constitutes a horizontal buckler nearly quadrilateral, which is divided longitudinally into three lobes, more or less distinct, by two longitudinal furrows. In front of this buckler is a small triangular and moveable plate, which seems to be a dependence of it, and which covers the antennular ring; its form varies, and as it may be an element in specific differences, M. Milne Edwards terms it the *frontal plate*. The ring which carries the eyes is small, nearly quadrilateral, and moveable on the succeeding segment: the *eyes* are large, short, and convex. The antennular ring is also nearly quadrilateral and moveable, but larger, and gives insertion to the *internal antennæ* by its anterior border on each side of the ophthalmic ring. These appendages are directed forwards; their peduncle is long, slender, and composed of three cylindrical joints, and they terminate in three multiarticulate filaments of moderate length. The *second pair of antennæ* are inserted under the anterior border of the carapace, on each side of the antennular ring, and are formed nearly the same as in the *Erichthians*: the first joint of their peduncle is large and short, and continues itself with an articulation equally stout, which carries at its extremity a great oval blade, analogous to the palp or middle branch of the thoracic limbs, and the basilary scale of the external antenna of the shrimps; the internal branch, which, ordinarily, is greatly developed, remains here slender and so small, that it only seems to be an appendage of the middle branch; it springs from the anterior angle of the common basilary joint, and presents a peduncular portion, composed of two cylindrical joints and of a terminal multiarticulate filament. The *epistome* is very much elongated and constitutes a great projecting mass nearly triangular, the base of which directed backwards forms the upper lip. The *mouth* is situated towards the posterior third of the carapace, and presents on each side a mandible furnished with a small palpiform stem, which is directed forwards on the sides of the epistome: these mandibles are vaulted, and terminate in two diverging branches with dentilated borders, one of which ascends vertically in the interior of the œsophagus. A lower lip, deeply notched, closes the mouth behind, and is applied against the mandibles. The *first pair of jaws* are small, and furnished within with a denticulated lamina on the border, and with a conical lobe bent back upon itself, and terminated by spines: externally these organs carry also a small rudimentary appendage. The *second pair of jaws* are more developed, and cover the whole of the rest of the buccal apparatus; they are lamellar, nearly triangular, and composed of many joints placed end to end. The members, which ordinarily constitute the second pair of jaws, form, as in the preceding tribe, two long, slender, and cylindrical feet, which advance on each side of the head, and bear considerable resemblance to the external jaw-feet of certain macrourous decapods; the vesicular blade fixed to the base of these organs is rather large. The succeeding pair of limbs, which in the decapods constitute the anterior jaw-feet, acquire here a great development, and take the form of raptorial or captatory feet; they are in general bent back thrice upon themselves, and their form calls to mind the anterior feet of the insects of the genus *Mantis* [MANTIDÆ]; the conformation of their claw varies a little, and thus furnishes characters for distinguishing the true *Squillæ* from the *Gonodactyli*. The three succeeding pairs of thoracic limbs, instead of being directed outwards like the raptorial feet, are directed forwards, and applied against the buccal apparatus; they are inserted upon a semicircular line, and the last touch at their base and are brought between the preceding, so that the thoracic ring to which they belong seems at first sight to be apod; their confirmation is essentially the same as in the preceding tribe. The same is the case with the three last pairs of thoracic feet: only they are more developed than in the Erichthians; their appendage is sometimes styliform, sometimes enlarged, and the joint which terminates them is in general lamellar, oval, and ciliated on the border. The rings which carry these three last pairs of feet, and even that which precedes them, resemble almost entirely those of the abdomen, only they descend but little or not at all laterally on the outside of the insertion of the limbs. The *abdomen* is very large, and constitutes a powerful natatory organ: the caudal fin which terminates it is of great size; the basilary joint of the limbs of the penultimate segment is very long, very large, and is prolonged posteriorly into a great pointed blade, which advances between the two terminal branches of those organs; the internal branch consists, as ordinarily, of an oval blade, with ciliated borders; but, as in the preceding tribes, the external branch is composed of two joints placed end to end, of which the first is of some size, and the second lamellar. The false feet of the five first abdominal rings are very large; the basilary joint is quadrilateral, and carries two lamellar branches, the external of which gives attachment by its posterior surface, close to its peduncle, to a great ramose branchia disposed in the form of a plume.

The same author observes that the internal structure of the *Squillians* differs considerably from that of the decapods. The *heart*, instead of being quadrilateral, and enclosed in the middle part of the thorax, has the form of a long vessel, rather enlarged anteriorly, which extends nearly throughout the length of the abdomen as well as of the thorax, and which furnishes laterally in each of the rings which it traverses a pair of arterial branches; by its anterior extremity, this dorsal vessel gives origin to three branches, which seem to be the analogues of the ophthalmic and antennary arteries of the decapods; and, posteriorly it terminates by a small artery which penetrates into the last abdominal segment. The venous sinuses, in which the blood collects before it goes to the branchiæ, are extremely large; the principal cavity belonging to this system occupies the median line of the body, and goes below the intestine and between the lateral muscular masses of the abdomen; its lower wall is formed by a blade of cellular tissue, which encloses in its thickness the ganglionary nervous cord, and which is joined (accolée) to the teguments of the lower surface of the abdomen; on each side it communicates with the intermuscular lacunæ which surround the base of the false feet, and lead to the branchiæ. The peduncle of each of these last organs encloses two longitudinal vessels, the external of which seems to be the afferent canal, and the internal the efferent canal: this last conduit is continued superiorly with an irregular canal, with walls formed only of very fine cellular tissue, and which ascends on the lateral parts of the abdomen, and plunges between the upper longitudinal muscles and the viscera, to reach the upper surface of the heart, where may be seen a double series of branchio-cardiac apertures.

The *stomach* is very large, and advances into the head very far before the œsophagus, which is vertical and extremely short. The solid work (charpente solide) of this organ is much less complicated than in the decapods, and is reduced nearly exclusively to the subpyloric portion, which forms a species of valvule in front of the entrance of the intestine. This last tube is straight, and is surrounded with a cellular and granular mass which appears to be the liver, and which gives origin laterally to small prolongations which insinuate themselves between the muscles of the base of the feet.

This organ, according to M. Duvernoy, is a nervous sinus; but M. Milne Edwards thinks that the appearance which gave rise to this opinion depends on alterations which take place in the *Squillæ* after death, for the results of the dissection of several fresh individuals appeared to the latter incompatible with this new determination proposed by the scientific professor of Strassburg. (See *Compte Rendu*, 8th May, 1837.)

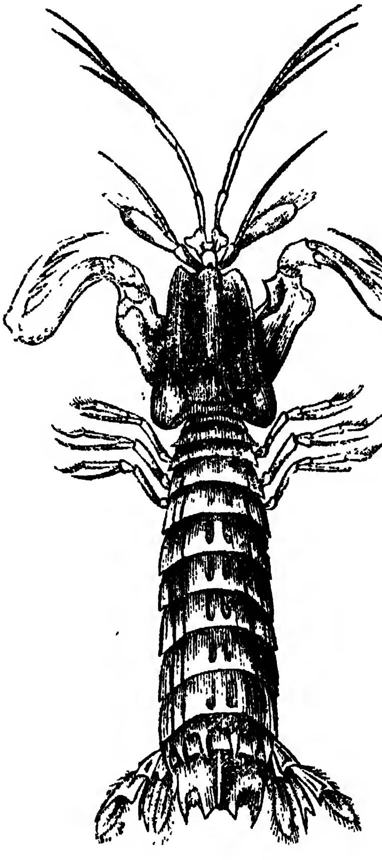
The organs of generation are situated above the digestive apparatus. In the male there issues from the base of each of the posterior feet a long slender cylindrical and white tube, which, in making a great number of circumvolutions, is directed backwards on the sides of the intestine, and terminates towards the anterior third of the abdomen in a whitish and lobulated mass, which is the analogue of the testicle, and which extends to the anus. The penes have the form of two horny tubes, the length of which is often very considerable. The ovary occupies the same place as the testicle, but is larger.

The nervous system presents nearly the same disposition as in the greater portion of the macrourous decapods; in the abdomen the ganglions are well developed, and the cords double; it is the same with the thoracic ganglions of the three last pairs, but all those of the anterior portion of the thorax are united in a single oval mass.

Genera.—*Squilla; Gonodactylus; Coronis.*

Squilla. (Rondeletius.)

M. Milne Edwards points out that the true *Squillæ* are probably more carnivorous than the other crustaceans of this tribe, for they are furnished with much more powerful offensive arms. The claw which terminates their raptorial feet has a falcular form, the sharp edge of which is provided with long pointed teeth, and can be received into a groove of the corresponding border of the hand, which is equally compressed, and in general armed with spines on its prehensile border. The three last pairs of thoracic feet carry a slender, cylindrical, and elongated appendage, which represents the palp. The body is in general more slender and narrowed behind the carapace than in the other *Squillians*.



Squilla, seen from above.

Locality, Habits, &c.—*Squillæ* show themselves in the British Channel; but the species which are numerous are abundant only in the seas of warm regions; they keep in general at a distance from the coast, and at considerable depths. Their abdominal false feet are continually in motion, and they swim with great swiftness, striking the water with their powerful tail.

M. Milne Edwards divides the true *Squillæ* into two subgenera:—1, *Squilles Fines-tailles;* and, 2, *Squilles Trapues.*

1. Slender Squillæ.

The species arranged by M. Milne Edwards under this subgenus are remarkable for the narrowing of the posterior portion of their thorax and the gradual enlargement of the abdomen. The carapace, enlarged backwards, hardly reaches the anterior edge of the thoracic ring which precedes the three last segments provided with feet. The rostral plate hardly ever covers the ophthalmic ring. The last segment of the abdomen is never furnished with moveable marginal spines. The subgenus is divided by M. Milne Edwards into the following sections:—

a. Species whose abdomen presents above neither crests nor large tubercles, and has its last segment twice and a half as wide as it is long; rounded and hardly dentilated.

Example, *Squilla maculata.* Length from ten to twelve inches, and rather more. Colour yellowish; with three bluish bands on the carapace and a similar transversal band on the articulation of the rings of the abdomen.

Locality.—The Asiatic Seas.

β. Species whose abdomen presents above many longitudinal crests, or large elongated tubercles, and has its last segment in general nearly as long as it is wide.

* *Rostral plate not covering the ophthalmic ring.*

Example, *Squilla Mantis.* Length six or seven inches and upwards. Colour very pale yellowish grey.

Locality.—The Mediterranean.

* * *Rostral plate entirely hiding the ophthalmic ring.*

Example, *Squilla Ferussaci.* Length about four inches. Moveable claw armed with three teeth only. Colour purplish washed with greenish.

Locality.—The coasts of Sicily.

2. *Stout Squillæ.*

This subgenus has the body very convex, all of a size, without any notable narrowing at the back part of the carapace. The posterior portion of the thorax is as wide as the abdomen, and the carapace reaches ordinarily to the antepenultimate thoracic ring. The rostral plate covers the ophthalmic ring entirely. The two posterior teeth of the last ring of the abdomen carry each at their extremity a moveable spine.

Example, *Squilla stilifera.* Last segment of the abdomen furnished above with seven delicate crests; two moveable spines inserted near the median line. Length about three inches.

Locality.—The Isle of France.

Gonodactylus. (Latreille.)

This genus bears a strong resemblance to the *Stout Squillæ* (Squilles Trapues). The principal distinction lies in the mode of conformation of the raptorial feet. The last joint of these organs, in lieu of having the form of the claw lamellar and strongly dentated, is straight, styliform, more or less convex at its base, and presents at most only vestiges of teeth on its prehensile border, which is enlarged. In general the convexity of the basilary portion is very considerable, and suffices to distinguish these crustaceans at the first glance.

* *Rostral plate armed on the median line with a long spiniform tooth.*

Example, *Gonodactylus Chiragra.* Length about three inches and a half.

Localities.—Probably all the seas of warm climates; Mediterranean, American coasts, Seychelles Islands, Trincomalee, and Tongataboo.

* * *Rostral plate rounded and nearly pointed in front.*

Example, *Gonodactylus Scyllarus.* Length about four inches and a half.

Localities.—Indian Seas and the coasts of the Isle of France.

Coronis. (Latreille.)

This form does not appear to M. Milne Edwards to differ sufficiently from the *Squillæ*, properly so called, to authorize its generic separation; but as he had not observed it himself, he continues to retain it as a genus. The following is Latreille's character:—

Lateral and posterior appendage of the third joint of the six last feet (the adactylous and thoracic) in form of a membranous blade or battledore (palette), which is nearly orbicular and a little bordered (rebordée).

Example, *Coronis Scolopendra.* (See Guerin, *Iconographie*, pl. 24, fig. 2.)

STOMATE'LLA. [HALIOTIDÆ, vol. xii., p. 16.]

STOMATES (from the Greek στόμα, an 'opening,' or 'mouth'), in Botany, are small longitudinal openings occurring in the epidermis of plants, and usually bounded by two or more lunate or kidney-shaped vesicles. The epidermis of plants has been described by Brongniart and others as consisting of three parts, which may be easily demonstrated by a lengthened maceration. The outermost of these consists of an 'extremely delicate homogeneous pellicle,' which does not present any decided marks of organization, and is perforated in places where the stomates exist. The second part consists of a single layer, sometimes of more than one, of flattened vesicles of cellular tissue. These vesicles are very small, and of various figures, but the most frequent form is the hexagonal. The third

part of the epidermis is the stomates, which are placed under the above-mentioned pellicle and on the same plane with the layer of flattened vesicles.

The first botanist who observed the existence of stomates was Grew, who, in his 'Anatomy of Plants,' published in London, in 1682, gave an imperfect representation of these organs, and stated that they existed on several parts of plants, but he gave them no especial name. Malpighi afterwards described their existence in the epidermis of Marchantiaceæ, where they are very large, but entirely overlooked them in the higher plants. Guettard was the next writer who noticed them, and, believing them to perform the office of glands, called them *glandes miliaires* (glandulæ miliares). Saussure also thought them glandular bodies, and called them cortical glands. Hedwig and Gleichen were the first to give accurate drawings of them; and from that time their existence excited general attention, but they received a variety of designations. Hedwig called them *spiracula* and *pori exhalantes*; De Candolle, *pores corticaux*; Krocker, *rimæ annulatæ*; Mirbel, *pores allongés*. Sprengel and other German writers designate them as Spaltöffnungen; Rudolphi called them pores of the epidermis; Link proposed the name stomata, which has since been adopted by De Candolle, Brongniart, and Mirbel in France, and Lindley and Henslow in England. Link has however since proposed the name of Hautdrüsen (skin glands), and this term is adopted by Meyen and later German botanists.

The structure of the stomates is best seen in the monocotyledonous plants, in which they generally occur of a larger size. They are quite imperceptible to the naked eye, but may be discovered by a lens of low power. In general they will be found to consist of two kidney-shaped bodies, which are merely cells of cellular tissue filled with a green matter, and from this circumstance contrast with the transparent cuticle in which they are placed. The kidney-shaped bodies lie with their incurved edges presented to each other, and their extremities unite with each other so that they leave between them a little oval chink or opening. This opening communicates with the parenchyma of the leaf or other organ underneath the cuticle, and at this point the cellular tissue is loose, and frequently a large cavity is observed, into which the stomate opens. Nees von Esenbeck, Brown, and others denied at first that the space between the kidney bodies was an opening, but the observation of later writers seems to have proved this point. (Lindley, *Introd. Bot.*, p. 52.) This difference among observers may perhaps be explained by the fact that the kidney-shaped bodies have a power of contracting and dilating, and thus closing or opening the space between them. This was first observed by Comparetti, and has since been confirmed by other writers.

The stomates are not all composed of two cells; those of Marchantia, according to Mirbel, are composed of four or five cells, which are arranged circularly, forming an upper outer rim of the stomate. Sometimes additional cells are found above these, but they differ little, except in their arrangement, from the cells of the tissue by which they are surrounded. This is one of the simplest forms of stomate. In *Nerium oleander* the stomates consist of cavities in the cuticle, which are filled up with little hairs. Dr. Lindley has described in Nepenthes two sorts of stomates, 'the one oblong, semitransparent, and almost colourless, with numerous pellucid globules in the cavity of the cells; the other roundish, much more opaque, and coloured red.' Although the form of the stomates is most frequently elliptical, they are sometimes quite spherical, as in *Oncidium altissimum*, and Link has noticed them of a quadrangular form in *Yucca gloriosa*.

The stomates are mostly arranged irregularly upon the surface of the epidermis, occupying generally about equal distances from each other. There are however some remarkable exceptions. In the grasses, for instance, and some other monocotyledonous plants, the stomates are arranged in regular rows, which run parallel with the bundles of woody tissue which enter into the composition of the leaf. In *Phormium tenax* and in Pinus the stomates are also arranged in a longitudinal series. In *Begonia spathulata* the stomates on the under surface of the leaves are collected together in the form of little rosettes. The same is seen in *Crassula cordata* and *arborescens*.

Stomates are found on plants whenever there is a distinct epidermis, and they exist on nearly all the parts of a plant exposed to the light. In the lower cryptogamic plants, as mosses, fungi, lichens, and algæ, they have never been found. Plants growing in the dark do not possess them, nor are they present on roots or the ribs of leaves. They are found on the bark of herbs and trees, but in the latter only whilst the bark is herbaceous. In those plants which live under water, as the Zostera, Ceratophyllum, and Potamogeton, they are not found. Those parts of the leaves of some plants which are concealed under the ground, as in the onion, &c., have no stomates. All the parasitical plants which have not a green colour, as the Orobanchaceæ, Lathrea, and Monotropa, are destitute of stomates, whilst those which are green, as the Loranthus, have abundance. They are only rarely found upon the filaments of the stamens, the anthers, or the styles. With the exception of Canna, they have not been found on the seeds of plants, nor are they present on fruits, except such as are membranous.

Stomates are not always present on both surfaces of the leaves. They are however much more frequently absent on the upper than on the under surface of the leaf.

The number of stomates contained in a given surface varies very much in different species and families of plants. Many observers have occupied themselves in counting them, and the following table gives the result of some of the observations of Sprengel, Krocker, Thomson, and Lindley on this point:—

Names of Plants.		Number of Stomates in a square inch.	
		Under side.	Upper side
Lilium album . .	Sprengel	17,280	3,556
——— bulbiferum .	Hedwig	83,000	not count
Tradescantia discolor .	Sprengel	9,000	
Alisma Plantago .	Thomson	16,000	12,000
Andromeda speciosa .	..	32,000	none
Hydrangea quercifolia	..	160,000	none
Sempervivum tectorum	..	6,000	10,710
Rumex acetosa .	..	20,000	11,088
Viscum album . .	..	200	200
Prunus Laurocerasus	Lindley	90,000	none
Crinum amabile .	..	20,000	20,000
Stapelia (stem) . .	..	..	15,000
Cactus (stem) . .	..	..	15,000
Aloe (leaf) . .	..	20,000	25,000
Yucca . . .	..	40,000	40,000
Pinus halepensis .	Krocker	2,700	
—— Abies . .	..	3,600	
Aloe nigricans . .	..	7,200	
Citrus aurantium .	..	409,824	
Solanum sanctum .	..	448,704	

Meyen, who records Krocker's calculations, does not state on which side of the leaf he observed the stomates.

Brown is of opinion that the figure, number, and size of stomates might often be made use of to indicate the affinities of genera and natural families of plants, and has proved that this is the case in Proteaceæ. Schleiden also, in a recent paper, has pointed out the relations and differences of these organs in Cactaceæ, Coniferæ, Piperaceæ, and other orders.

The different names that have been given to the stomates by various writers will at once indicate the differences of opinion that have existed with regard to their functions. It was an early opinion that they were excretory glands, and that through their agency the bloom that exists on the leaves, &c. of many plants was formed. But this exists, as on the surface of plums, where there are no stomates. Link and Meyen still maintain that they are glands. The latter observes that the structure of the cells of the stomates is precisely similar to that of many of the glands of plants, and that supposing the stomates were only looked upon as organs by which exhalation is effected, yet that process is one of excretion rather than of simple evaporation. It is for this reason he still calls them Hautdrüsen (skin-glands), and looks upon them as excretory organs.

Bonnet found that leaves when flagging were restored by placing one of their surfaces in water, and hence he concluded that one of the functions of the stomates was to absorb moisture from the atmosphere, but the hygroscopicity of vegetable tissue would account for this absorption,

and would effect it when necessary without having recourse to the supposition that a special organ was provided for it.

That they are organs by which the process of exhalation is carried on as a vital process, there is much reason to suppose. They exist in the greatest abundance in those parts of plants in which this operation is going on, they are also most abundant in membranous leaves, which are known to exhale most, and are deficient in succulent leaves, in which there is little exhalation. It was long ago observed by Comparetti, that the mouths of the stomates were open by day and closed at night, and this is quite in accordance with what we know of the action of light on the function of exhalation. It is more active in the day, and the mouths of the stomates are opened to allow of the exit of the vapour. Another argument in favour of this view is derived from the non-existence of stomates in those families of plants in which no proper transpiration takes place.

For further information consult Meyen, *Pflanzen Physiologie*; Lindley, *Int. Bot.*; De Candolle, *Organographie Végétale*; Brongniart, *Ann. des Sc. Nat.*, 1834.

STOMA'TIA. [HALIOTIDÆ, vol. xii., p. 17.]

STO'MIAS, a genus of fishes of the Pike tribe (family *Esocidæ*), distinguished by the muzzle being very short, the mouth very deeply cleft, the opercula reduced to small membranous laminæ; the maxillaries fixed to the cheeks; the intermaxillary, palatine, and maxillary bones are rather sparingly furnished with teeth, and these are long and hooked, and similar teeth are observable on the tongue. The body is elongated, the ventral fins are placed very far back, and the dorsal fin is placed opposite the anal fin, on the hinder extremity of the body.

Only two species of this genus are known, both of which are inhabitants of the Mediterranean. One, the *Stomias barbatus*, has been so called on account of its having a long barbule on the chin. Both species are of a black colour, but have numerous rows of small silver spots on the abdomen.

The genus *Chauliodus*, Schn., appears to be closely allied to the present fishes, presenting much resemblance in the structure of the head and jaws, which are furnished, in front, each with two teeth which cross when the jaws are closed. The dorsal fin is placed opposite the interval of the pectoral and ventral fins, which are not placed so far back as in *Stomias*. The first ray of the dorsal is produced into a filament. One species only is known, the *Esox stomias* of Schneider, a fish found at Gibraltar (and apparently nowhere else), and which attains the length of about fifteen or eighteen inches, and is of a deep green colour.

STONE, METEORIC. [AEROLITES.]

STONE. [CALCULUS.]

STONE. [STAFFORDSHIRE.]

STONE, EDMUND, a mathematician of North Britain. He was of humble origin, having been the son of a gardener in the service of the duke of Argyle, and he was born near the end of the seventeenth century, probably on one of the duke's estates. A servant of the family taught him, when a boy, to read; and with no other guide than his own genius, he at length became learned in the higher branches of mathematical science.

The duke, happening accidentally to become acquainted with the extent of his scientific acquisitions, took an opportunity of drawing from him an account of the steps by which he had attained them, and learned with surprise that, from a desire to understand the use of a rule and compasses, and how to make computations relative to the art of building, the youth from books only had taught himself arithmetic and geometry, together with as much of Latin and French as enabled him to read scientific works in those languages.

It will be readily imagined that the young man was not left in his then obscure situation: in fact the duke, his master, generously gave him an employment which allowed him to have sufficient leisure for his studies; and he continued to cultivate the mathematical sciences to the end of his life. He was elected a fellow of the Royal Society in 1725, and there is inserted in the 'Philosophical Transactions' (vol. 41) a paper by him in which is an account of two lines of the third order, which are not mentioned by Sir I. Newton or by Mr. Stirling.

It is not known from what circumstance Mr. Stone lost the support of the noble family which had patronised him; but it appears that in the latter part of his life he subsisted by giving lessons in mathematics, and that he died in poverty in 1768.

Mr. Stone published, in 1723, a translation of Bion's 'Treatise on Mathematical Instruments;' in 1726, a 'Mathematical Dictionary,' in 1 vol. 8vo.; and in 1730 a translation of the Marquis de l'Hôpital's 'Analyse des Infiniment Petits,' together with a treatise by himself on the 'Method of Fluents, or the Inverse Method of Fluxions.' This work has been criticised by John Bernoulli; but the mistakes which occur in it are candidly ascribed to the circumstances under which it was written. In the following year Stone published 'The Elements of Euclid,' in 2 vols. 8vo., and in 1735 a translation, from the Latin, of Dr. Barrow's 'Geometrical Lectures.'

STONECHATS. [WARBLERS.]

STONEHENGE, an assemblage of upright, horizontal, and prostrate stones on Salisbury Plain, England; generally supposed to be the remains of an antient Druidical temple. The name is probably derived from the Saxon, *stan*, stone, and *heng*, or *hang*, to hang or support. By the Welsh antiquaries it has been called *choir-gaur*, *chorea-gigantum*, or, according to Stukeley, *chorus magnus*, the great choir or circle.

Stonehenge, with the far-famed pyramids of Egypt, and other works of the same class, may be considered as the oldest monuments of man's labour. Being anterior to all written evidence, their history is entirely unknown, and they have been the subjects of much unprofitable speculation, some of which however will require a short notice.

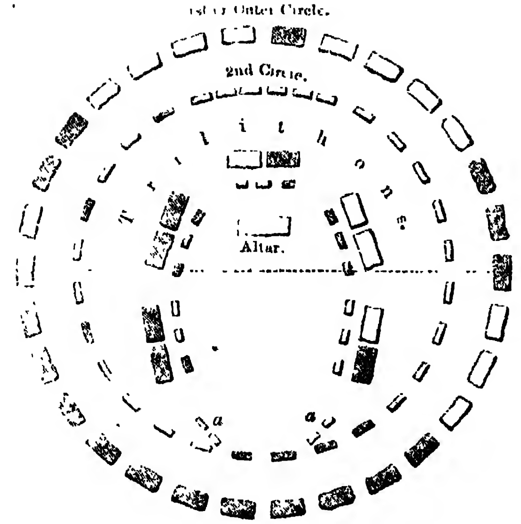
Stonehenge is situated about two miles due west of the town of Amesbury, and seven north of Salisbury, in Wiltshire. From its singular character and peculiar situation, which is easy of access, it has attracted more attention than any other relic of antiquity in Great Britain. Viewed at a distance it appears a trifling object; for its real magnitude appears diminished in the extensive plain or open country which surrounds it; and even on a near examination it often fails to satisfy expectation.

In various parts of the world there are circles of upright stones, some of which consist of a single circle, and others of many circles: but Stonehenge is of a peculiar character, and is, we believe, wholly unlike any other antient monument. Many of the stones have been squared, or hewn by art, and the horizontal stones of the outer circle are carefully attached by mortices to the uprights, which have tenons: whereas nearly all other examples of what are generally called Druidical circles are composed of rough unhewn upright stones, without imposts. The accompanying diagrams will give an exact notion of the form, arrangement, position, and general design of the whole structure, in its original as well as in its present state.

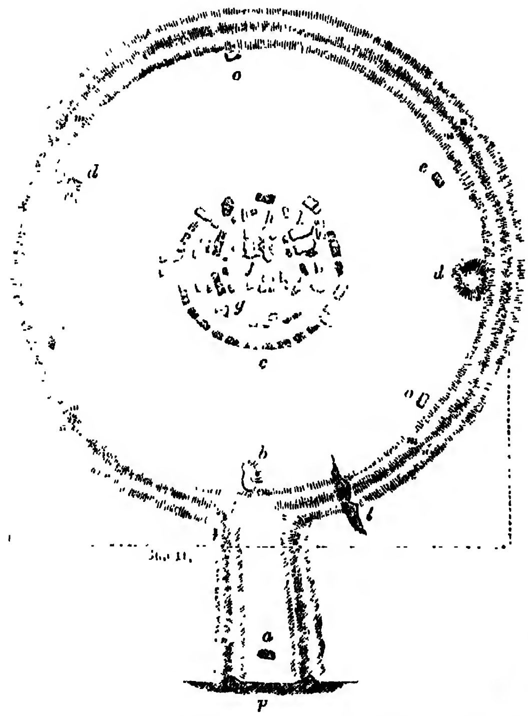
The stones are surrounded by a circular vallum, or bank of earth, within a ditch or foss. Withinside this bank are three stones, two of which are in an upright position, and the other is prostrate. It has been conjectured by Browne, with some probability, that those originally formed part of a circle. In the centre of the enclosed space is what is usually called the temple itself, which comprised originally an outer circle of thirty upright stones, at nearly equal distances apart, sustaining as many stones in a horizontal position, forming a continuous impost. Each of the upright stones had two tenons or projections on the top, which were adapted to fit into and fill up two mortices or hollows in each superincumbent slab. Within this was another, or second circle, consisting of about the same number of perpendicular stones, of much smaller size, and without imposts. This circle enclosed an elliptical arrangement of large and small stones: the former, which were divided into groups of three stones each, are called trilithons by Dr. Stukeley and subsequent writers. There were five trilithons, each of which consisted of two upright stones, and an impost, covering or extending to the extreme edges of the standing stones. Before each trilithon stood three small upright stones; and in the central space, or adytum, of the temple (in front of the principal trilithon) was a large flat stone, called the altar. This description will be readily understood by an examination of the accompanying cuts.

The plan No. 1 shows the original design of the main part of the temple: the stones which have fallen, or are entirely removed, are marked in outline, whilst the stones remaining in their original positions are shaded. The plan No. 2 shows, more minutely, the present dilapidated state of the edifice, together with the vallum and fosse, and other exterior works.

No. 1.



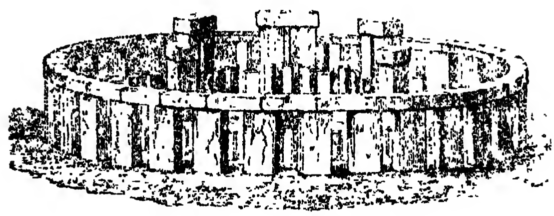
No. 2.



Ground-plan of the whole work in its present state, showing the approach or avenue from the north east, with one stone still standing, *a*, at the distance of about one hundred feet from the ditch; *b*, fallen stone in the ditch; *c* supposed entrance through the exterior circle, in a line with the avenue, and near the middle of the temple. *d*, *d*, two cavities or hollows in the ground; *e*, *e*, two stones, adjoining the surrounding bank; *f*, a flat stone, usually called the altar; *g*, a small impost stone with two mortices. The small size of this stone, as compared with the imposts of the outer circle and those of the trilithons, has caused much conjecture and speculation among the writers on this monument, as it could not have belonged to or formed any part of those portions of the structure. Some contend that it was part of a small trilithon in that situation, and that there was another of similar proportion on the opposite side, or on the right hand of the entrance (See Plan No 1, *a*, *a*) : *h*, the tallest stone in the place, and forming part of the chief trilithon, or most prominent part of the structure; its corresponding stone, as well as the impost, have fallen: *i*, *i*, two standing and nearly perfect trilithons: *k*, a fallen trilithon, its three stones perfect, showing the full forms, proportions, and junction of the uprights and the impost; these fell in the year 1797: *l*, section through bank and ditch, marked *m*, *n*; *p*, section of banks on each side of the avenue: *o*, *o*, sites of two stones near the surrounding bank.

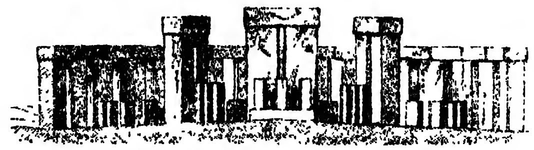
With respect to the two principal circles, the restorations given by Stukeley, Inigo Jones, Wood, and Smith, vary in no essential particulars; but as regards the number and arrangement of the trilithons, and the small upright stones before them, they differ materially from each other. Jones, for instance, made the number of trilithons *six*. The plan No. 1 (from Stukeley) seems fully justified by the existing remains, as shown in plan No. 2, whilst the discordant opinions on this point are easily accounted for by the fact that the central portion of the temple is comparatively in a much more ruinous condition than the two principal circles.

No. 3.



Stonehenge.—Perspective Elevation.

No. 4.



Stonehenge: section 1 to 2 (ground-plan, No. 1), 105 feet.

The plans (1 and 2), perspective view (3), and section (4), render it unnecessary to give a description of the present state of Stonehenge. The dimensions of the stones, and the space occupied by the structure, as nearly as they have been ascertained, are—

Diameter of the space enclosed within the vallum or bank . . .	300 feet.
Height of vallum . .	15 feet.
Diameter of the outer circle	100 feet.
Do. of the second circle .	83 feet.
Height of the stones of outer circle	14 (*sides* 7 feet by 3).
Do. of trilithons .	16 ft. 3 in., 17 ft. 2 in., 21 ft. 6 in.
Do. of one of the small stones before the same . .	7 ft. 6 in.

The stones of the outer circle, the trilithons, the stones in the avenue, and adjoining the vallum, are, according to Dr. Townson, in 'Tracts and Observations on Natural History,' &c., 'a pure, fine-grained, compact sand-tone, differing only a little in their colour, some being white, and others inclining to yellow.' They precisely resemble the grey-wethers and numerous other detached masses which lie on the surface of the downs in the vicinity of Avebury and Marlborough. The stones of the second circle, and the row within the trilithons, consist of 'a fine-grained grünstein,' interspersed with black hornblende, felspar, quartz, and chlorite, excepting four in the circle, one of which is a siliceous schist, another is an argillaceous schist, and the others are hornstone, with small specks of felspar and pyrites. The slab or altar-stone is different from all these, being a kind of 'grey cos, a very fine-grained calcareous sandstone,' which strikes fire with steel, and contains some minute spangles of silver mica.

The surrounding plain is covered with a profusion of barrows and earth-works, perhaps unparalleled in any spot of similar extent in England, and probably in the world. Many of the barrows were opened by Sir Richard Hoare and his indefatigable coadjutor Mr. Cunnington, and were found to contain, in some instances, cists or chests, filled with burnt bones, and in others entire skeletons, with various relics of British and Roman art. Some other objects besides the barrows demand our notice. The principal of these are the avenue and the cursus, the former of which has been previously noticed. It is a narrow strip of raised ground, bounded on each side by a slight bank of earth, and extending in a straight line from the entrance, through the vallum of the structure on the north-east, to the distance of 594 yards, at which spot it divides into two branches, one of which continues southward, and is seen between two rows of barrows: while the other proceeds northward, and approaches within a few yards of the cursus. The cursus is a very curious and interesting appendage to Stonehenge, if it can be properly so considered. It is a flat tract of land, bounded by two parallel banks and ditches, and is situated about half a mile north-east of Stonehenge: it measures one mile five furlongs and 176 yards in length, and 110 yards in breadth. Its direction is from east to west; and at the former extremity is a mound of earth resembling a long barrow, which stretches entirely across it. The western extremity is destitute of any mound like that at the eastern end, but there

are two barrows irregularly placed near this end within the area of the cursus, a part of which appears also to be cut off by a slight bank. The original purpose of this bank is difficult to determine, for we can scarcely suppose that if the chariots started from the east end, they would be driven *over* this bank, to the termination of the course at this end. We should therefore be inclined to think that it had been raised at a later period, for some object distinct from racing, if there were not another similar bank thrown across a second and smaller cursus, which is situated at the distance of nearly a mile from the larger one. From the near resemblance of the above work to the genuine circus of the Romans, it is reasonable to suppose that, if not formed by the Romans, it was made in imitation of their chariot-course, and by a people familiar with their manners and customs. Hoare's 'Antient Wiltshire' contains a very interesting map, showing the surface of the plain around Stonehenge to the extent of about five miles from east to west by three miles from north to south. Within that area are two large encampments, two cursuses, other embankments supposed to mark British villages, and at least three hundred barrows or tumuli of various sizes and shapes. Hence it may be reasonably inferred that Stonehenge was a place of great importance in former ages.

The earliest published notice of Stonehenge occurs in the writings of Nennius, who lived in the ninth century. He narrates the particulars of the murder of four hundred and sixty British nobles at a conference between King Vortigern and Hengist, in the latter part of the fifth century, at or near the spot on which Stonehenge is situated; and attributes the erection of the monument to the surviving Britons, who thus endeavoured to perpetuate the memory of that tragical event.

The historical 'Triads of the Welsh Bards' refer its origin to the same cause, and relate that it was constructed by Merlin, after the death of King Vortigern. This likewise is the account of Walter Mapes [GEOFFREY OF MONMOUTH], who is very circumstantial in his narrative.

Geoffroy of Monmouth, who wrote in the 12th century, gives a similar account of its origin, with the addition of a legend, which is repeated by most subsequent writers. He states that Merlin employed supernatural agency to remove the stones from Kildare in Ireland and place them upright on Salisbury Plain; and he adds that they had been in the first instance conveyed to Ireland from Africa. The same story appears in Giraldus Cambrensis (1187), who mentions a similar monument which he had seen on the plains of Kildare.

Henry of Huntingdon, who also wrote in the twelfth century, discredits the story of Merlin; and says that no one can devise by what means or for what purpose such a work could have been raised. Neither Gildas, Bede, William of Malmsbury, Hovedon, Ingulphus, Matthew Paris, nor Florence of Worcester, have any notice of this remarkable monument; a circumstance which Henry of Huntingdon attributes to their inability to give any account of its origin or use.

Polydore Virgil (1534) says that it was raised by the Britons to the memory of Aurelius Ambrosius. Camden, who wrote in 1586, gives no opinion on its origin or purpose. His description and representation are so very erroneous, that it is doubtful if he ever visited the place. John Aubrey, in a manuscript referred to by Bishop Gisbon, and Sir Richard Hoare, attribute its origin to the Britons prior to the Roman invasion.

Such is the scanty information which our old writers contain about this curious monument of antient times. Modern writers on Stonehenge, rejecting all historical evidence, have raised their theories on purely speculative foundations. Inigo Jones, in his essay on Stonehenge, undertaken at the desire of King James I., and which was published in one small folio volume, by his son-in-law John Webb, A.D. 1655, endeavours to show that Stonehenge was a temple of the Romans, of the Tuscan order, dedicated to Cœlus; but he has committed palpable errors in his restorations, to say nothing of the absurdity of his general assertion. The next essay was written about 1660, and published anonymously, in Langtoft's 'Chronicle,' called 'A Fool's Bolt soon shot at Stonage.' The writer considers it to have been a British temple, commemorative of a victory gained by the Cangi of Somersetshire, over King Divitiacus and his Belgæ. In 1663 Dr. Charleton published his 'Reflections on Stonehenge,' in which he contends that it was erected by the Danes, in the time of King Alfred, as a place for the crowning of their kings. Charleton's 'Reflections' called forth an essay of 228 folio pages, in support of Inigo Jones, by his editor John Webb, published in 1664: this essay is of no value. In 1676 appeared a volume by Aylett Sammes, who remarks, 'Why may not these giants (alluding to the title of *Chorea Gigantum* given to this monument) be the Phœnicians; and the art of erecting these stones, instead of the stones themselves, brought from the furthermost parts of Africa, the known habitations of the Phœnicians?' To this sage question one may answer, why may not the stones have come from the moon, and dropped down in their present position?

Bishop Gibson, in his edition of Camden's 'Britannia,' 1694, after opposing the theories of Jones and Charleton, concludes, 'One need make no scruple to affirm that Stonehenge is a British monument; since it does not appear that any other nation had so much footing in this kingdom as to be authors of such a rude and yet magnificent pile.' The bishop thinks that some part of this temple may have been erected subsequently to the Roman invasion; a conclusion which seems to be very probable. With reference to its modern name, Gibson refers to a Saxon manuscript of good authority, printed by Dugdale in the 'Monasticon,' in which it is called *Stanhengist*, proving its traditional connection, at an early period, with Hengist. In 1720 J. G. Keysler, a learned German antiquary, published, at Hanover, 'An Explication of the *Anglo-Saxon* Monument of Antiquity on Salisbury Plain, called Stonehenge.'

In 1740 Dr. Stukeley published a folio volume, entitled 'Stonehenge, a Temple restored to the British Druids:' he attributes the work to the British Druids. The plates which accompany his volume are good; and Stukeley's restorations are valuable; but a huge portion of his essay is occupied with fanciful and irrelevant speculation.

J. Wood, an architect of Bath, published a series of elaborate plans of this structure, in 8vo., 1747. It is his opinion that it was a temple erected by the British Druids, about 100 years before the Christian æra.

The Rev. W. Cooke, in a treatise entitled 'An Enquiry into the Patriarchal and Druidical Religion, Temples, &c.,' 1755, supposes Stonehenge to have been held sacred by the Druids, and appropriated to the meetings of great assemblies, on civil as well as religious occasions; for which, he adds, 'the world does not afford a nobler spot.'

Dr. Smith's work on Stonehenge, called 'Choir Gaur,' 1771, gives a minute description of the structure, with a notice of most of the theories to which we have referred. He considers it to have been of Druidical origin, and that it was a 'great orrery,' erected as well for the purposes of astronomical observation as for religious ceremonials.

Edward King, in his 'Munimenta Antiqua,' devotes much space and applies great learning to the consideration of antient stone monuments. He conjectures that Stonehenge was constructed in the latest ages of Druidism, when that religion was struggling against Christianity.

Mr. Davies, the learned author of 'Celtic Researches,' 1804, and the 'Mythology of the Druids,' 1809, has discussed the question respecting the origin and use of Stonehenge perhaps with more research than any previous writer. He supposes that this structure and Silbury Hill are two of the three works alluded to in a Welsh Triad as constituting the greatest labours of the island of Britain; *i.e.*, 'lifting the stone of Ketti,' 'building the work of Emrys,' and 'piling the Mount of the Assemblies.' That Stonehenge is really a Druidical structure, the same learned writer remarks, 'is evident, from the language in which it was described, and the great veneration in which it was held, by the primitive bards, those immediate descendants and avowed disciples of the British Druids.' 'It was not exclusively dedicated to the Sun, the Moon, Saturn, or any other individual object of superstition; but it was a kind of Pantheon, in which all the Arkite and Sabian divinities of British theology were supposed to have been present.' As to its date, he remarks that 'it was a monument of venerable antiquity in the days of Hengist, and that its peculiar sanctity influenced the selection of the spot for the place of conference between the British and Saxon princes. Mr. Davies further cites a passage in Diodorus Siculus, who quotes Hecatæus, describing a round temple in Britain, dedicated to Apollo, which he concludes to have been most likely Stonehenge. (Diod., ii., 47.) Sir R. Hoare has entered more fully into this passage (*Antient Wiltshire*, i. 155),

The Rev. Jas. Ingram, in his 'Inaugural Lecture on the Utility of the Saxon Literature' (1808), considers Stonehenge to have been intended for a heathen burial-place, and the cursus adjoining as the hippodrome on which the goods of the deceased were run for at the time of the burial. This opinion is entitled to some consideration, from the vast number of barrows and other earth-works which abound in this part of the plain.

The late Mr. Cunnington, in Sir R. C. Hoare's 'History of Antient Wiltshire,' folio. 1812, observing the difference in quality and size between the stones of the exterior and interior circles, supposes that Stonehenge was erected at different times. He imagines that the larger stones, with their imposts, constituted the old or original work; and that the small stones of the second circle, and those of the inner range, were raised at a later time, as 'they add nothing to the grandeur of the temple.' But this opinion is not warranted by any example among the numerous Druidical circles of Great Britain; on the contrary, it seems more consistent to conclude that the second circle, of small, rough, unhewn stones, with another circle immediately within the ditch, and some other members now destroyed, formed the original or pristine temple, and that the larger hewn stones with imposts were afterwards added. Many arguments might be alleged in support of this opinion, and also to prove that the great circle of upright chiselled stones, with their imposts, and the third row of trilithons, were posterior to the former, raised by another class of people, and executed at a time when their principles and arts had been considerably changed. At the same time it is conjectured that an avenue of stones was raised, extending from the temple towards the cursus to the north-east, and also that those places for races and other sports were formed at a time when the inhabitants of Britain had intercourse with the Romans.

The 'Topographical Account, &c. of Wiltshire,' by J. Britton, forming the fifteenth volume of the 'Beauties of England and Wales,' 1814, contains an accurate description of Stonehenge and of other antiquities in its immediate neighbourhood.

In 1823 H. Browne published 'An Illustration of Stonehenge and Abury,' in which he endeavoured to show that both of those monuments were antediluvian, and even that the latter was formed under the direction of Adam. He ascribes the present dilapidated condition of Stonehenge to the operation of the general Deluge: 'for,' he adds, 'to suppose it to be the work of any people since the Flood, is absolutely monstrous.'

Godfrey Higgins, in a large 4to. volume, 1829, entitled 'The Celtic Druids: or an attempt to show that the Druids were the Priests of Oriental Colonies, who emigrated from India,' has given an elaborate account, with plates, of Stonehenge, but both the plates and the description are from the works of Stukeley, Sir R. C. Hoare, and others. His opinion is that Stonehenge 'was raised by the Druids, the priests of the nation, who were its sacred architects.'

About fifty years back Mr. Waltire gave lectures on Stonehenge, illustrated by models and drawings, and fancifully represented the temple as a place devoted to sacred and mysterious rites, and as forming a planisphere, in connection with the surrounding barrows and other works. Taking up a part of this theory, but allowing a wider latitude to conjecture, the Rev. E. Duke has lately published, in the 'Salisbury Journal,' a long series of essays, in which he endeavours to show that Stonehenge was one of the members, or planets, of a vast planetarium, representing the solar system, and extending over a wide extent of country, 'on a meridian thirty-two miles in length.'

The late John Rickman, in the 'Archæologia,' vol. xxviii., p. 399, supposes that 'Silbury hill, the Abury circus, and the avenues of approach to it, were not constructed earlier than the third century of the Christian æra, and that the more difficult operations requisite for the formation of Stonehenge may be assigned to the next century, or (to speak with due caution) that this temple was completed before the final departure of the Romans from Britain.'

The Rev. Thomas Maurice, in 'Indian Antiquities,' vol. vi., has a dissertation on Stonehenge, and endeavours to show that the Druidical rites and ceremonies of the West were derived from antient India, and that this monument or temple must have been erected more than 500 years before the Christian æra.

In 'Palestine: the Bible History of the Holy Land,' 8vo., 1841, by John Kitto, there is a learned essay 'On Antient Monuments of Stone, Druidical Remains,' &c., with an elaborate review of this much controverted subject.

In conclusion it may be observed that there appears much less reason for ascribing the erection of Stonehenge to any of the successive conquerors or colonists of Britain, than to its original inhabitants the Celtic Britons; and if this be admitted, it is a probable conjecture that the structure was erected for religious purposes under the direction of the Druids. The practice of commemorating an important event by raising a number of stones, is of the greatest antiquity; and there is nothing in the history either of the Romans or the Saxons to lead us to suppose that those nations ever erected temples or monuments like the stone circles of Avebury and Stonehenge.

STONEHOUSE, a township and parish in the county of Devon, 217 miles west by south from London, and about midway between the large towns of Plymouth and Devonport.

Apart from local distinctions Stonehouse would be considered as a component part of the one great town which Plymouth, Devonport, and Stonehouse really constitute. In a narrower point of view, Stonehouse would be regarded as a suburb of Plymouth, being on the same level, and connected with it by uninterrupted lines of buildings; while it is separated from Devonport by a creek, and by a long and steep ascent beyond, which is unoccupied by buildings: a toll-bridge over the creek makes the separation still greater. But when the Reform Act was drawn up, it was deemed proper to associate Stonehouse with Devonport in the exercise of the elective franchise, which neither had previously enjoyed. Stonehouse was constituted a township by this act, and is divided into two wards. It is under the jurisdiction of a bench of county magistrates, who sit every Tuesday at the so called town-hall, which is only a part of the watchhouse, which is used for the confinement of offenders until they are removed by order of the magistrates.

Stonehouse was originally called Hippeston, the name of a mansion first inhabited by Joel de Stonehouse, in the reign of Edward III. The original, or *West* Stonehouse, was on the other side of the water, at Cremhill, under Mount Edgcumbe, to the noble proprietor of which *this*, usually distinguished as *East* Stonehouse, also belongs.

For several centuries Stonehouse was a fishing village, with a small chapel. During the civil wars its population was between 700 and 800. The establishment of the Royal Naval Hospital in 1762, and of an extensive depôt for the Royal Marines in 1784, gave a great impulse to the prosperity of the place, which has, within the present century, been greatly strengthened by the late earl of Mount Edgcumbe, who, by granting leases on liberal terms, has caused the town rapidly to increase. The recent removal of the Royal Victualling Establishment from Plymouth to the extremity (Cremhill Point) of the peninsula on which Stonehouse is situated, will increase its prosperity.

The streets of Stonehouse are wider and more regularly laid out than we usually see in a town of its class. The houses are very neat, but small, except in two or three streets, which the gentry inhabit. There is no public building of any note, except those pertaining to the port of Plymouth, which have been already named. The parochial chapel of St. George, which has 1000 sittings, was built in 1789, and is a perpetual curacy, in the gift of the vicar of St. Andrews, Plymouth. The new chapel of St. Paul's, which has 950 sittings, was opened in 1831, and its minister is appointed by the incumbent of the parish. There is another episcopal chapel in the Royal Hospital. The Methodists, Calvinists, Independents, Baptists, and Roman Catholics, have their several places of worship, with sittings altogether for 2033 persons. In Stonehouse there are six commercial and classical schools, with 378 pupils; a national school with 188 boys and girls, and an infant school with 113 boys and girls. The Sunday schools are five, one belonging to the church, and the rest to the several denominations, with 752 children. Stonehouse has the usual charitable societies for the benefit of the poor, and an almshouse for eight poor widows has been lately established by Mrs. Bint. The workhouse is a plain structure, erected in 1801. There is a small library and a reading-room, connected with the Naval Club, which is not confined to the naval service. The market-place is a neat and convenient building. There are two annual fairs, one held in May, the other in September. The population of Stonehouse was 3407 in 1801, 6043 in 1821, and 9712 in

1841; but the last number is a very slight increase (141) upon 1831.

(*Statistics of the Three Towns*, by H. Woollcombe, Esq.; the *Guides* of the Rev. S. Rowe, and of G. Wightwick, with local information.

STONESFIELD FOSSILS. The accumulation of organic remains in the thin slaty limestones of Stonesfield is one of the most remarkable phenomena known regarding the distribution of the fossils in the oolitic rocks. Coniferous, cycadeous, and filicoid plants; lamelliferous corals, conchifers, gasteropods, cephalopods, crustaceans, insects, ganoid fishes, terrestrial and aërial saurians, marsupial mammalia; all these occur together, and suggest to the naturalist a variety of inferences and speculations. Viewed in their most general relations, the slaty beds of Stonesfield appear to be deposits produced in the sea near the shore in shallow water, at points to which fresh-water currents might send, at intervals, some of the spoils of the land. The marine conchifers are often found with valves united, and otherwise in conditions which indicate residence on or near the spot where they are buried; but the broken state of the land plants, the scattered elytra of insects, the detached state of the teeth and bones of fishes, saurians, and mammalia, seem the effect of transport from some distance. A great distance cannot well be supposed, for in that case we must imagine the course of a great river, and look for its effects over much wider areas than that of the Stonesfield fossils. There are indeed several rather similar deposits, and perhaps of the same or nearly the same geological date, in the oolitic series of Northamptonshire and Yorkshire, but they seem to be due to separate areas of littoral agitation.

Admitting then the original *habitat* of the Stonesfield fossils to be nearly identical with their present locality, we may venture to ask, to what local fauna and flora in any of the natural regions of the existing land and sea does the Stonesfield series of life offer the greatest analogy? Professor Phillips (*Treatise on Geology*, 1837, vol. i., p. 105), in discussing generally the resemblance of fossil and recent local groups, observes that 'it is impossible to turn to Australia without a suspicion that the anomalous productions of that region have more than the average resemblance to the primeval fauna and flora. For here, and near it, tree-ferns, *cycadeæ*, araucariæ, casuarinæ, grow upon the land; corals and sponges abound on the coast even of Van Diemen's Land; while *trigoniæ*, cerithium, isocardia, a cardium like C. hillanum of the green-sand, and quadrupeds of the peculiar marsupial races to which the Stonesfield animal is referred by Cuvier, seem to invite attention to the yet unexplored sea and land of this prolific region, as likely to yield still further analogies to antient animals and plants, and by consequence to furnish new and important grounds for determining the antient physical conditions of the globe.' A similar view of the determinate analogy of the races of animals and plants now living in Australia, and long since buried in the oolitic strata, has presented itself to Professor Owen, whose decision of the marsupial and mammiferous character of the lower jaws of quadrupeds found at Stonesfield is a gratifying confirmation of the opinions of Cuvier and Buckland, and one of the most important data for the palæontologist. (*Report to the Brit. Assoc.*, 1841.)

There is yet no complete catalogue published of the very numerous species of fossils found at Stonesfield, and preserved in the collections of Buckland and other geologists. Many of the plants are noticed by Sternberg, Brongniart, and Hutton; Mr. Sowerby has figured many of the shells; the work of Agassiz may be consulted for the fishes; Dr. Buckland's *Bridgwater Treatise*, and Professor Owen's *Report*, already alluded to, and other works of the same author, for the reptiles and mammalian remains.

STONHOUSE, SIR JAMES, who was originally a physician, afterwards a clergyman, and who became a baronet late in life, on the death of a distant relation, was born July 20, 1716, at Tubney, near Abingdon. His father was a country gentleman, and died when his son was only ten years old. He was educated at Winchester School, and afterwards at St. John's College, Oxford, where he took his degree of M.A. in 1739, that of M.B. in 1742, and that of M.D. in 1745. He was indebted for much of his medical knowledge to Dr. Frank Nicholls, with whom he resided for [illegible] years in his house in Lincoln's Inn Fields. He attended St. Thomas's hospital for two years under Sir Edward Wilmot, Dr. Hall, and Dr. Lethe[illegible]nd, and carried on his medical studies for two years more at Paris, Lyon, Montpellier, and Marseille. On his return he settled at Coventry, where he married the eldest daughter of John Neale, Esq., member of parliament for that city. This lady, who died in 1747, soon after their marriage, in the twenty-fifth year of her age, is introduced as one of the examples of frail mortality in Harvey's 'Meditations,' and is further commemorated there in a note. In 1743 Dr. Stonhouse removed to Northampton, where his practice became very extensive. He was in all respects a great benefactor to the poor, and, among other schemes for their relief, founded the County Infirmary. During his residence at Northampton the celebrated Dr. Akenside in vain attempted to get a footing, for he found that Dr. Stonhouse, as Johnson observes, in his Life of Akenside, 'practised with such reputation and success, that a stranger was not likely to gain ground upon him.' After twenty years' practice in Northampton, Dr. Stonhouse quitted his profession, assigning as his reason that his practice was too great for his time and health; but neither the natural activity of his mind nor his unceasing wish to do good would permit him to remain unemployed. As he was particularly fond of the study of divinity, he determined to take orders, and was ordained deacon by the special favour of the bishop of Hereford, in Hereford cathedral, and priest the week after, by letters dismissory to the bishop of Bristol, in Bristol cathedral. In May, 1764, he was presented to the living of Little Chevrel, and in December, 1779, to that of Great Chevrel, where he applied himself to the duties of his station with fervour and assiduity, and became very popular as a preacher. About ten years before this, he had married his second wife Dr. Stonhouse's piety, for which he was most admired, had not always been uniform. He tells us that he imbibed erroneous notions from Dr. Nicholls, and that he was for seven years a confirmed infidel, and did all he could to subvert Christianity. He went so far as to write a keen pamphlet against it; the *third* edition of which he burnt. He adds, 'for writing and spreading of which, I humbly hope, as I have deeply repented of it, God has forgiven me, though I never can forgive myself.' His conversion to Christianity (which he attributes to some of Dr. Doddridge's writings), and the various circumstances attending it, were such, that he was persuaded to write the history of his life. This he intended for publication after his death, but, in consequence of the suggestion of a friend, and his own suspicions lest a bad use might be made of it, he was induced to destroy it. He died at Bristol-Wells, Dec. 8, 1795, in the eightieth year of his age. Among other ways of doing good, Sir James Stonhouse was convinced that the dispersion of plain and familiar tracts on important subjects was one of the most important and he accordingly wrote several of these, some of which have been adopted by the Society for Promoting Christian Knowledge. Much of his general character and conduct, his sentiments, and the vicissitudes of his professional employment, may be learned from his correspondence, published in 1805, 2 vols. 12mo., with the title, 'Letters from the Rev. Job Orton and the Rev. Sir James Stonhouse,' &c. See also *Gent. Mag.*, lxv., lxvi., and lxxxi.; and Chalmers, *Biog. Dict.*

STONY STRATFORD. [BUCKINGHAMSHIRE.]

STOP, a set of pipes in an organ. [ORGAN.]

STOPPAGE IN TRA'NSITU is the seizure by the seller of the goods sold during the course of their passage to the buyer.

In explaining the nature of the right of stoppage in transitu, it will be necessary to show—

1. Under what circumstances it exists.
2. By whom and how it may be exercised.
3. How it may be lost.
4. What is the effect of it.

When goods are sold on credit without any agreement as to the time of delivery, the right to the possession of them, as well as the property in them, vests immediately in the buyer. Originally it would appear that the right to the possession and the ownership were considered absolute, the consequence of which, in case of the buyer's bankruptcy or insolvency immediately after the sale, was, that the goods, although unpaid for, and still in the possession of the seller, formed part of the insolvent buyer's estate, and were liable to distribution among his creditors. This was at variance with the merchant law of other nations, and was considered inequitable, and, accordingly, about the year 1690, the Court of Chancery first introduced the doctrine of stoppage in

transitu. (Wiseman v. Vandeput, 2 Vern., 203; Snee v. Prescott, 1 Atk., 245.) It has been since universally recognised in the courts of common law. By virtue of this doctrine the seller was held entitled, in case of the insolvency or bankruptcy of the buyer, to stop the goods at any time before they came into the buyer's possession. During such time they are said to be in transitu, by which, as Lord Mansfield says, is meant every sort of passage to the hands of the buyer; that is, until they have reached the place agreed upon between the buyer and the seller as the place of their ultimate destination. This is not necessarily the actual premises of the buyer; it may be any place, as, for instance, a seaport, the warehouse of the carrier, or even of the seller himself, if such has been assigned as the place of destination. The transitus however continues not only while the goods are actually in motion, but also while they are in any place of deposit connected with their transmission. Goods in the custody of a warehouseman may thus be said still to be in transitu, and with respect to goods so circumstanced, questions very frequently arise as to whether the right of stoppage in transitu still exists or not. When these questions are not determinable by the express terms of the contract, it may become material to inquire whether any other act remains to be done on the part of the seller previous to the actual delivery. If not, it is to be presumed that the transitus is at an end. The buyer's right to possess may be rendered absolute by various acts, as by the seller giving up to the buyer the key of the warehouse where the goods lie, the delivery of part from the bulk of them, the exercise of acts of ownership upon them by the seller, with permission of the buyer. [SALE.] After the transitus of the goods has commenced, it was held by Lord Kenyon that the natural termination of it could not be anticipated by the act of the buyer in meeting the goods and taking possession of them while on their route. The law however now appears to be, that if an actual delivery has taken place, even though by means of such an anticipation of it, the right of stoppage is lost. The part delivery of goods does not destroy the right. In a case where part of a cargo was delivered on a wharf, and was afterwards reshipped, it was held that the seller still retained the right of stoppage in transitu as regarded the whole of the goods.

When the transitus has once been entirely accomplished, the right of stoppage in transitu is extinguished, and cannot again be revived.

The right of stoppage in transitu may be exercised, although a part of the price of the goods has been paid, but not if upon the general account between the buyer and the seller the balance is in favour of the buyer. A seller is justified in refusing to part with his goods under such circumstances as would entitle him to stop them in transitu after the transitus has commenced.

2. The seller, or some one acting on his behalf, is the only person who can exercise the right of stoppage in transitu. No other person, however much interested, possesses this right. Thus a surety to the seller for the payment of the price of the goods, or one who had a lien upon them before he parted with the possession of them, has no right to stop them in transitu. A party however who bought goods for a correspondent from third parties, who were unknown to his correspondent, and charged him a commission upon the price, was held to be, as regarded his correspondent, in the light of an actual seller, and therefore entitled to stop the goods in transitu.

The buyer of goods cannot act as the agent of the seller for the purpose of stopping goods in transitu. No act of his, such as placing the goods in the hands of third parties, &c., will operate as a stoppage in transitu.

In order to effect a stoppage in transitu, it is not necessary that corporal possession of the goods should be obtained. A notice to a wharfinger not to surrender them to the buyer, to a carrier not to deliver them, &c., is a valid exercise of the right.

3. The right of stoppage in transitu being a right of the seller against the buyer, no right, generally speaking, derived to third parties through the buyer only, can defeat it. Such parties stand in the same condition towards the seller as the buyer stands, through whom their rights are derived. Thus a carrier cannot, as against the seller, claiming a right of stoppage in transitu, detain the goods on the ground of a lien upon them for the carriage of other goods for the buyer. If the buyer resell the goods and become insolvent before they have come into his possession, the right of stoppage in transitu still remains.

But in the case of goods which are subject-matter of a bill of lading, a dock-warrant, &c., the rule of law is otherwise. A party to whom a bill of lading is consigned, or a dock-warrant indorsed, has a property which may be the subject of an assignment; and a *bonâ fide* assignee upon performance of the conditions, if any, of the bill of lading, becomes entitled, upon the assignment, to the possession of the goods absolutely as against the consignor, even in case of the insolvency of the consignee. This was decided as to bills of lading, after great consideration, in the case of Lickbarrow v. Mason (6 East, 21). But if the assignment of the bill of lading is fraudulently accepted by the assignee for the purpose of defeating the consignor's right of stoppage in transitu, it will be inoperative for that purpose, and will give the assignee, as against the consignor, no right beyond that possessed by the consignee himself at the time of the assignment.

By the 4 Geo. IV., c. 83, and 6 Geo. IV., c. 94, a factor is invested with a power of pledging, even for debts of his own, bills of lading, the property of his principal, when have been consigned to him [FACTOR]; but if he pledge also bills belonging to himself, the principal has a right to compel the pledgee to apply in the first instance the whole proceeds of the latter towards discharging the debt due from the factor to the pledgee. And if the consignor of a bill of lading assigned away in pledge, has taken the proper steps for exercising his right of stoppage in transitu against the consignee, he will be entitled to recover from the assignee the overplus of the proceeds that remains after satisfying the debt for which it has been pledged.

4. It would appear, although the point has never yet been expressly decided, that the exercise of the right of stoppage in transitu does not immediately rescind the sale and revest the property of the goods in the seller. Buller observes that it gives him a right to 'retain them till the original price be paid.' By 'original' he means the price bargained for at the time of the purchase, as distinguished from the value in the market at a subsequent period. The position also that the seller still retains the right to stop in transitu, although part of the purchase-money is paid, seems inconsistent with the supposition that the exercise of the right amounts to a rescission of the contract and sale. If this be correct, when the seller stops the goods in transitu, they still remain the property of the buyer, subject to being redeemed by him from the possession of the seller on payment of the price agreed on. They probably continue subject to this condition until the time allowed for credit has expired, where a time has been fixed on, and where it has not, until a reasonable time has elapsed. Probably also, in the case of goods of a perishable nature, the seller might be held to be authorized to sell the goods for the benefit of both parties. (Abbot *on Shipping*, tit. 'Stoppage in Transitu;' Cross *on Lien and Stoppage in Transitu*; Smith's *Leading Cases*, note to 'Lickbarrow v. Mason.)

STORACE, STEPHEN, a composer whose auspicious and brilliant career was arrested by the hand of death just as he had attained the age when most of those who are destined to distinguish themselves are but beginning to be generally known, was born in London, in 1763. His father, a Neapolitan (who added a *t* to his name on his coming to England), played the double-base at Drury Lane theatre, and married a sister of the well-known Dr. Trusler (who was famous by her manufacture of plum-cakes at Marylebone Gardens), the fruits of which union were, the subject of the present sketch, and *Anna*, the justly celebrated singer.

When about twelve years old, Stephen was placed by his father in the Conservatorio St. Onofrio, at Naples, where his progress fully justified the sanguine expectations excited in London by the budding of his genius. After completing his studies, he visited the different cities of Italy, giving various proofs of his talents, accompanied by his sister, a pupil of Sacchini, who at once was recognised as a first-rate vocalist. They then proceeded to Vienna, and reached the imperial city at the time that the Duke of York (then Bishop of Osnaburg) arrived there, who immediately honoured them by his notice, and never after withdrew his patronage. Signora Storace was speedily engaged at the emperor's Italian theatre, at a salary then thought prodigious—500*l.*; and her brother composed for the same an opera, *Gl' Equivoci*, the substance borrowed from Shak-

spere's *Comedy of Errors*. Portions of the music he afterwards used in his *Pirates*, and in *No Song, no Supper*.

In March, 1787, Storace and his sister returned to England, and were immediately engaged at the King's Theatre, the lady as first comic singer, and her brother as director of the music. Her success was most decided, but the intrigues of the Italian performers were too harassing for his sensitive nature, and he withdrew in disgust to Bath, devoting his time to drawing, an art for which he had much talent. In 1789 he produced his first opera at Drury Lane, *The Haunted Tower*, his sister appearing in the principal character, and this was performed no less than fifty times during the season. In 1790 he brought out *No Song, no Supper*, written by Prince Hoare. In 1791 appeared the *Siege of Belgrade*, altered by Cobb from *La Cosa Rara*, in which much of Martini's music is mixed up with Storace's. *The Pirates* was given, for the first time, in November, 1792: the performers were Kelly, Dignum, Sedgwick, Suett, John Bannister, Parsons, Mrs. Crouch, Miss De Camp (afterwards Mrs. C. Kemble), Mrs. Bland, and Signora Storace. The picturesque scenery was from designs made at Naples, by the composer himself. *The Prize* was brought out in 1793; *Lodoiska*, translated from the French by John Kemble, the music selected from the rival operas of the same name by Kreutzer and Cherubini, with additions by Storace, in 1794; and the same year also produced *The Iron Chest*, by George Colman, the younger, the incidental music by Storace. The composer's attendance on the first rehearsal of this, while under the influence of a severe attack of gout and fever, cost him his life. He returned from the theatre to his bed, whence he never rose again, dying on the 19th of March, in the thirty-third year of his age. Mr. Colman, in his preface to this play, describing the difficulties it had to encounter, thus eloquently mentions 'an event which deprived the world of a genius, and himself of a most intimate and valued friend;' and adds, 'nay, even the composer of the music—and here let me breathe a sigh to the memory of departed worth and genius, as I write the name of Storace—even he could not preside in his department. He was preparing an early flight to that abode of harmony where choirs of angels swell the note of welcome to an honest and congenial spirit.'

'At the time of his death he had a new opera, *Mahmoud*, in preparation. He had been to Bath to hear Braham, who then had not made his appearance on the London stage, and engaged him for Drury Lane. This however, by the assistance of Signora Storace and friends, was completed, and performed for the benefit of the widow and child of the composer, on the 30th of the month in which he breathed his last, and, supported by John Kemble's admirable acting, and Braham's not less admirable singing, was most successful.'

Our space will not allow us to particularise the other works of this highly-gifted amiable man; but it is only just to say of those here enumerated, that they 'abound in spirit, taste, science effectively but not pedantically displayed, strong feeling, and good sense;' and to add, that their author, in these as in other matters, evinced a vigorous and cultivated mind. 'His opinion on literary subjects was much respected by the best critics, and he was often consulted on points unconnected with his professional pursuits.' (*Harmonicon*, vol. vi.)

STORAX. [STYRAX.]

STORK, ABRAHAM. Notwithstanding the great merits of this eminent marine painter, and the high estimation in which his works have always been held, we cannot find that any author has been able to ascertain the year of his birth, or the master under whom he studied, or indeed whether he had any instructor. It is certain however that he was a most assiduous student of nature. He made accurate sketches of such objects, suited to his department of the art, as he thought might be introduced into his compositions, and hence every object in his pictures has the impress of truth.

He was equally successful in representing ships, either at sea or at anchor in port, either in calms or in storms. In his views of seaports, there is an extraordinary variety of ships, boats, and barges, with a great number of figures. This extraordinary number of figures engaged in every kind of employment incidental to a seaman's life, is in fact one of his chief characteristics. His most celebrated picture is that representing the reception of the Duke of Marlborough in the river Amstel, in which he has introduced an inconceivable number of vessels, barges, yachts, &c., superbly decorated, and crowded with figures, in a variety of costume, according to their rank and condition. Notwithstanding the extent of this composition, there is no confusion. It is painted with great spirit and highly finished. The colouring of this artist is very agreeable; his touch light, firm, and spirited; and his figures, though small, are designed with the utmost correctness. He died at Amsterdam, the place of his nativity, in 1708. (Pilkington; Fuseli; Bryan.)

STORK. [HERONS, vol. xii., p. 168.]

STORM, EDWARD, a Danish poet of some note, was the son of a clergyman at Guldbrandsdalen in Norway, where he was born, August 21, 1749, on the very same day with his literary contemporary Thomas Thaarup, whose mother is said to have dreamt that a rival to her own child would be born about the same time at Guldbrandsdalen. Storm began his literary career at the age of twenty-five, with a short heroic comic poem in six cantos, entitled 'Brøger.' Being written in hexameters, it recommended itself at the time as a novelty, nor is it without merit in regard to that minute descriptive painting of familiar objects and circumstances which stamps the Idyls of Voss; but it will bear no comparison with Holberg's 'Peder Paars,' with which it inevitably forces a comparison. He was far more successful in his 'Fables and Tales,' which are some of the best in the language, and acquired considerable popularity. They first appeared in 1783, and in the following year a second edition of them was published. His 'Infödretten,' a poem in four cantos, of the didactic class, and one or two other productions of a similar kind, have many fine passages and poetical beauties: his reputation however now rests chiefly on his lyrical productions, which have obtained for him a place in Danish literature by the side of Thaarup. Storm was for some time manager of the theatre at Copenhagen, which post he held at the time of his death in 1794. (*Skilderie af Kiöbenhavn.*)

STORNAWAY. [ROSS AND CROMARTY.]

STOTHARD, THOMAS, an eminent painter, the son of a publican who kept the 'Black Horse' in Long-acre, was born there on the 17th of August, 1755. At a very early age he evinced a taste for drawing in copying Houbracken's heads and other engravings. At eight years old he was placed at school at Stretton, near Tadcaster, the birth-place of his father. There he remained till he was of age to be apprenticed, when he was removed to London, and bound to a pattern-drawer for brocaded silks. The last year of his apprenticeship was given up to him in consequence of the decline of the trade. During the period of his service, Mr. Stothard exercised himself diligently in the study of nature from flowers and other subjects of still-life. His first efforts in a higher branch of art were designs for the 'Town and Country Magazine,' published by Harrison, in Paternoster-row; and soon after he gained high repute by his admirable compositions for Bell's 'British Poets,' and the 'Novelist's Magazine,' works which caused him to be employed in the illustration of almost every publication which for many years issued from the press in England requiring pictorial ornament. During this period he diligently studied at the Royal Academy. The first picture that he exhibited at that institution was the subject of Ajax defending the body of Patroclus. In the year 1785 he was elected an associate of the Royal Academy, and advanced to the rank of Royal Academician in 1794. In 1810 he was appointed deputy librarian to Mr. Birch, and on the death of that gentleman, in 1812, succeeded as librarian. Among the more important of his works may be enumerated his designs for Boydell's Shakspere, his Canterbury Pilgrims, the Flitch of Bacon, and the Wellington Shield, of the last of which he made an etching. His largest performance is the fresco painting of the staircase at Burleigh, the seat of the marquis of Exeter. He also designed the ceiling of the Advocates' Library at Edinburgh. The first style of painting adopted by Mr. Stothard was that of Mortimer, whose chief characteristics he closely imitated, indeed so exactly that many of his early works are mistaken for those of that vigorous painter. In his later productions however he followed the bent of his own genius, which was essentially gentle. He is supposed to have made upwards of five thousand designs, three thousand of which have been engraved, and although, as might be expected in so large a number, there is a sameness and mannerism of style, yet

truth, nature, simplicity, and grace are always apparent. In his comic subjects he was very happy, without in any one instance descending to vulgarity, whilst in his representations of female beauty his drawing is replete with purity of design and delicacy of execution. For several months before his decease, though Mr. Stothard's bodily infirmities prevented his attending to his labours as an artist, he would not relinquish his attendance at the meetings and lectures at the Royal Academy and in the library, notwithstanding extreme deafness prevented his hearing what was passing. He died on the 27th April, 1834, at his house in Newman Street, where he had resided more than forty years, and was buried in Bunhill-Fields burial-ground. He had a numerous family, the most eminent of whom was Charles Alfred, the author of 'Monumental Effigies of Great Britain.' A great number of his works have been engraved by Collins, Heath, Parker, Cromek, and Medland, and there are several engraved portraits of him, the principal of which are by Worthington, after Harlowe, and by Bond, after Jackson.

(*Annual Biography and Obituary; Gentleman's Magazine.*)

STOTHARD, CHARLES ALFRED, an antiquarian draughtsman, a son of Thomas Stothard, Royal Academician, was born in London, on the 5th of July, 1786. In 1807 he was admitted as a student of the Royal Academy, where he was soon distinguished for the chasteness and elegance of his copies from antique sculpture. In the following year he became a student in the Life Academy of the same institution, and attended at the British Institution, Pall Mall, to study from the pictures by the old masters. In 1810 he executed his first historical picture, 'The Death of Richard II. in Pomfret Castle,' in which the costume of the period was strictly adhered to, and the portrait of the king taken from his effigy in Westminster Abbey. As early as the year 1802, Mr. Stothard had been accustomed to make drawings from the monuments in the churches at Stamford and other places near Burleigh, the seat of the Marquis of Exeter. This occupation he undertook at the recommendation of his father by way of improving his knowledge of costume, as being valuable to a painter of historical subjects. This practice, together with a sight of some unpublished etchings by the Rev. P. Kerrich, of Cambridge, from monuments in the Dominican and other churches in Paris, suggested to him the idea of a work on the monumental effigies of Great Britain, of which the first number appeared in June, 1811. The work was accompanied by an advertisement, stating that the objects of the undertaking were, to give the historical painter a complete knowledge of the costume adopted in England from an early period of history to the reign of Henry VIII., to illustrate history and biography, and to assist the stage in selecting with propriety the costume for the plays of Shakspere. The success of the work was complete, and at once established the reputation of the author both as an antiquarian and an artist. In successive years he occupied himself in making excursions in search of monumental antiquities; and during the summer of 1815 he proceeded so far northward as the Picts' Wall to make drawings for Lysons' 'Magna Britannia.' In the same year he was appointed historical draughtsman to the Society of Antiquaries, and in 1816 was deputed by that body to make drawings from the tapestry at Bayeux. He left England for that purpose in September, and after having visited Paris, proceeded to Chinon, and discovered in the adjacent abbey of Fontevraud those interesting works the existence of which since the first French revolution had been matter of doubt, namely, the monuments of Henry II., his queen Eleanor of Guienne, Richard I., and Isabella of Angoulême, wife of King John. The abbey had been converted into a prison, and these effigies were placed in a cellar, where they were subject to injury from the prisoners. He made accurate drawings from these figures, and succeeded not without difficulty in discovering the painting on their surface. When visiting the abbey of L'Espan, near Mons, which he found converted into a barn, he discovered, under a quantity of wheat, the effigy of Berengaria, queen of Richard I. At Mons he also discovered the beautiful enamelled tablet of Geoffrey Plantagenet, which he considered the earliest specimen of a sepulchral brass, and of armorial bearings depicted decidedly as such. On his return to England, he suggested to government the removal of the Fontevraud effigies to Westminster Abbey, a suggestion which, though not acceded to, had the effect of causing them to be removed to a place of security.

In 1817 he made a second, and, in 1818, a third journey to Bayeux, in company with his wife, whom he had recently married. After completing his drawings of the tapestry, he made a tour in Normandy and Brittany, when he discovered at Ploermel the effigies of the dukes of Brittany, at Josselin those of Sir Oliver de Clisson and his lady, and at Vannes several others in a mutilated state. In 1819 he laid before the Society of Antiquaries the complete series of drawings from the Bayeux Tapestry, together with a paper, in which he proved that the tapestry was really a work coeval with the Norman invasion, a period assigned to it by tradition, and not, as attempted to be shown by the Abbé de la Rue, a work of the time of Henry I. The paper was printed in the nineteenth volume of the 'Archæologia;' and on the 2nd of July Mr. Stothard was elected a Fellow of the Society of Antiquaries. He soon after visited various places in Norfolk and Suffolk, for the purpose of making drawings for his monumental subjects, and whilst so engaged, he accidentally saw in a newspaper of the day an account of the discoveries then recently made on the walls of the painted chamber in the House of Lords. He immediately proceeded to London, and made a series of drawings from the paintings, of which, not long before his death, he prepared a paper, in which he investigated their age. In 1820 he travelled in the Netherlands, and, on his return, published the ninth number of his 'Monumental Effigies.' Early in 1821 he prepared a tenth number for publication, and also finished a large plate of the Royal Effigies at Fontevraud. He also began a work on seals, and left behind him about thirty unpublished drawings of the scarcest of our regal and baronial ones. Another of his undertakings was a work illustrative of the age of Queen Elizabeth. In May in the same year he left London for Devonshire, for the purpose of making drawings for the Rev. D. Lysons's account of that county. He arrived at Beer-Ferrers on Sunday the 27th, and after attending church, commenced a tracing of the portrait of Sir William Ferrers in the east window. For this purpose he stood on a ladder about ten feet from the ground, but one of the steps having broken, he was thrown with such violence against a monument, that he was killed on the spot. The most important work of Mr. Stothard is that before mentioned—the monumental effigies. The writings of Mr. Gough on the same subject are extremely valuable, but the delineating part contains so many errors, and bears so little resemblance to the style of the originals, that the labours of Mr. Stothard were appropriately devoted to the preservation of accurate as well as tasteful representations of those relics of antiquity.

(*Memoirs of the Life of C. A. Stothard*, by his widow; *Annual Biography and Obituary; Gentleman's Magazine.*)

STOUR. [ESSEX; KENT.]

STOURBRIDGE. [WORCESTERSHIRE.]

STOURPORT. [WORCESTERSHIRE.]

STOVE. [WARMING AND VENTILATION.]

STOVE-PLANTS. [HOTHOUSE.]

STOW, JOHN, was born in London, about the year 1525. His father Thomas Stow belonged to the company of Merchant Tailors, and both his father and his grandfather appear to have been tradesmen of credit and substance. Both had monuments in the church of St. Michael's, Cornhill, in which parish they dwelt, and which has probably also the honour of having given birth to the subject of the present article.

It is certain that Stow, in the earlier part of his life, followed some trade, and he is expressly called a tailor in at least one document of the time. It appears that in his own day he was regarded as secretly attached to the old religion, and he was more than once exposed to some danger on that account: he was certainly however no bigoted Romanist: his inclination in that direction was an antiquarian rather than a theological feeling; he did not sympathise much with the destructive work of the Reformation; but he does not deny that both doctrine and practice were purer under the new than under the antient system; and his chief patrons and friends were some of the heads of the Established Church, to which also there can be no doubt that he always professed to belong.

He had probably been given from early life to the investigation of the national antiquities; but about his fortieth year, as we learn from himself, he left his business and applied himself altogether to this his favourite study. The

different accounts he gives however vary somewhat as to the time at which he took or acted upon this resolution. Thus, in the edition of his 'Summary,' published in 1567, he describes the compilation of the work some years before as having resulted from his thinking it good at vacant times to take him to his 'old delectable studies;' in the edition of 1573, he speaks of its being then eight years, since, leaving his own peculiar gains, he had consecrated himself to the search of our famous antiquities: in the edition of 1598, his expression is, that it was 'full thirty-six years' since he had done so; and in the dedication of his 'Annals' to Archbishop Whitgift, dated 24th November, 1600, he says, 'It is now nigh forty years . . . . . since I first addressed all my cares and cogitations to the study of histories and search of antiquities.'

The accounts that have been given of Stow's publications are for the most part very defective, confused, and contradictory. Passing over for the present his 'Survey of London,' about which there is no difficulty, we will first exhibit the statements we have met with as to his other works, that have the air of having been drawn up with the greatest care:—

I. Strype, in an elaborate 'Life of Stow,' extending to 27 double-columned folio pages, prefixed to his edition of the 'Survey of London,' tells us that the first book Stow put forth of the history of England was his 'Summary of the Chronicles of England,' from the coming in of Brute unto his own time; that he set about this in 1562, on the suggestion of Lord Robert Dudley (afterwards the famous earl of Leicester); that when the work was published (it is not said in what year), it was dedicated, 'with the continuation and increase thereof from time to time,' to that nobleman; that not long after, namely, in 1573, it was enlarged and reprinted, and again dedicated to Leicester, in an address in which Stow speaks of his lordship's 'generous acceptation of many works presented unto him by others as well as himself,' and states that 'he fell upon the study and pains of examining and collecting of this English history five years before he set forth this Summary;' that before this larger Summary came forth, he had published several lesser Summaries; that 'after twenty-five years,' (it is not said from what time,) his fortune growing low, he addressed a petition to the lord mayor and aldermen, in which, as Strype quotes the words from the original, though without giving us the date of the paper, he represented that for the space of twenty-five years past (besides his 'Chronicle,' dedicated to the earl of Leicester), he had set forth various Summaries dedicated to the lord mayor, aldermen, and commoners of the city, and that he minded shortly, if God so permitted, to set forth a far larger Summary or Chronicle of the city and citizens thereof than had yet been published: that some years after he addressed another petition to the mayor and aldermen, in which, after telling them that he was of the age of threescore years and four, he goes on, as before, to speak of the Chronicles (not Chronicle) and divers Summaries he had set forth, 'for the space of almost thirty years last past;' that after his Summary, he published, in the year 1600 (now after near forty years study of history) his 'Flores Historiarum,' that is, his 'Annals of this land,' from the time of the antient Britons to his own, 'which,' however, 'were nothing else but his Summary greatly enlarged;' that 'this book was set forth again in the year 1605, by Stow himself, with enlargements, in the black letter, in a thick quarto;' that he intended to publish, or leave to posterity, a far larger volume, but died before he could accomplish that design; 'and where that laborious work of his is,' adds Strype, 'I know not; only we are told that he left the same in his study, orderly written, ready for the press, but that it came to nothing. We all know that another edition of the Annals was set forth in folio by Edmond Howes, some years after the author's death. Perhaps those historical collections are preserved in the curious repository of Sir Simonds Dewes, as some say the rest of Stow's books and papers are, many of which are now reposited in the incomparable library of manuscripts erected by the earl of Oxford and Mortimer.' Such is the substance of between four and five long wordy columns which Strype devotes to the matter. 'So that,' he concludes, 'Stow's histories, which he collected and wrote, were three, viz. his Chronicle, his Summary of Chronicles, and his Annals. The two latter he printed; but that Chronicle which he called his largest work was never printed.'

II. The account given by the writer of the article on Stow in the 'Biographia Britannica' is, that his 'Summary of the Chronicles of England' first appeared in 1565; that it was reprinted with additions and improvements in 1570, 1575, and 1590, and, with a continuation by Edmond Howes, in 1607, 1610, 1611, and 1618; that an abridgement of this 'Summary' appeared in 1566, and was reprinted with continuations in 1567, 1573, 1579, 1584, 1587, 1598, and 1604; that there was an edition of the 'Summary,' under the title of 'Annales,' published in 4to. in 1592; but that his 'Annals,' properly so called, first appeared in 1600, under the title of 'Flores Historiarum, or Annals of England;' and finally, that 'from his papers Edmond Howes published afterwards that folio volume which goes under the name of Stow's Chronicle,' first in 1615, and again in 1631, but that 'even this doth not contain all that "far longer work" which Mr. Stow mentions, and intended to have published, leaving it in his study orderly written, ready for the press.' The manuscript, it is added, 'is not in the British Museum, with others of our author's manuscripts,' which, as already stated, were among those of the earl of Oxford, now forming what is called the Harleian Collection.

III. Watt, in his 'Bibliotheca Britannica,' makes Stow to be the author of no fewer than four different printed works on English history, namely—1, his 'Summary of English Chronicles,' of which there were editions, in 8vo., in 1565, 1570, 1575, 1579, 1590, and, with continuations by Howes, in 1607, 1610, 1611, and 1618; 2, his 'Summary of Chronicles abridged,' printed in 8vo., in 1566, 1567, and 1579; 3, his 'Chronicles of England,' published, in 4to., in 1580, 1584, 1587, 1592, and, under the title of 'Flores Historiarum, or Annals of this Kingdom,' in 1600 and 1604, each time with a continuation; 4, his 'Annals, or a General Chronicle of England,' 12mo., 1573; 4to., 1592; 16mo., 1598; 4to., 1602, 1605, and, continued by Howes, folio, 1614-15, and again 1631. This account appears to be a mere jumble of blunders, made up from the 'Biographia Britannica' and probably the entries in some booksellers' catalogues.

It does not appear that there are really more than two historical works of Stow's which can properly be called different, namely, his 'Summary' and his 'Annals.'

1. The earliest edition of the 'Summary' that we have seen is a very small 18mo. volume, in black letter, entitled 'The Summarie of Englishe Chronicles (lately collected and published), abridged and continued till this present moneth of November, in the yeare of our Lord God 1567, by J. S.; imprinted at London, in Flete Street, nere to S. Dunstone's church, by Thomas Marshe.' But this is not the first edition of the book, for in a dedication to the Rt. Hon. Roger Martin, lord-mayor, the aldermen, and commoners of London, the author states that in first publishing this his small travail of English Chronicles, he thought good to dedicate it to the earl of Leicester; 'but now,' he adds, 'at the request of the printer and other of my loving friends, having brought the same into a new form, such as may both ease the purse and the carriage, and yet nothing omitted convenient to be known; and, besides all this, having example before my face to change my patron (reserving still my printer, as careful of his advantage rather than mine own), I am bold to submit it unto your honour and worship's protection,' &c. Another edition of the same size, but a greater number of pages, is entitled 'The Summarye of the Chronicles of Englande, lately collected, newly corrected, abridged, and continued unto this present year of Christ, 1573, by J. S.' It is dedicated to the Rt. Hon. Lionel Ducket, lord-mayor of London, the aldermen, and commoners; and in a curious address 'To the reader,' Stow says, 'Calling to memory, gentle reader, with what diligence, to my great cost and charges, I have travailed in my late Summary of the Chronicles, as also the dishonest dealings of somebody towards me (whereof I have long since sufficiently written and exhibited to the learned and honourable),* I persuaded with myself to have surceased from this kind of travail, wherein another hath used to reap the fruits of my labours. But now, for divers causes thereto moving me, I have once again briefly run over this small abridgment,' &c. There were probably many editions of the 'Summary' after this; but the only other published in Stow's lifetime which we have seen is one, also in 18mo., and in black letter, printed in 1598, which has his name at

* The person alluded to is his brother chronicler Richard Grafton, as appears from various indications.

full length on the title-page, and is dedicated to the Right Honourable Sir Richard Saltinstow, Knt., lord-mayor of London, the aldermen, the master, wardens, and assistants of the Merchant Tailors, and all the commons of the same city. In the dedication he speaks of the former editions of his 'Summary,' and also his 'late published Chronicle and Annals;' and again, of this his 'abridged Summary,' and other his 'larger Chronicles;' but we believe these various expressions refer only to one other work besides the 'Summary.' The next edition of the 'Summary' that we have met with is entitled 'The Abridgment of the English Chronicle, first collected by M. John Stow, and after him augmented with very memorable antiquitties, and continued with matters forreine and domesticall, unto the end of the yeare 1610, by E. H., gentleman; imprinted at London for the Company of Stationers, 1611.' This volume is a 12mo., in black letter, like its predecessors; but the type is larger, and it does not seem to contain, with the exception of the Continuation, much more than what Stow had already printed, although Howes, the editor, tells us that, besides the time the present edition had cost him, he had laboured five years on a preceding edition of the work, which appears to have been published in 1607. The present volume has two dedications, one to Sir Henry Rowe, who was lord mayor in 1607, the other to Sir William Craven, who was elected to that office in 1610. Stow's 'Summary' seems to have been in constant demand for half a century after its first publication; it was the popular manual of our national history; hence the book was laid hold of by the Stationers' Company, who probably brought out new impressions of it every three or four years, continued to the date of publication like their almanacs and other similar handbooks.

2. Of the 'Annals,' a copy now before us in 4to. and black letter wants the title page, but appears to have been printed in 1592, to which year the history is brought down. At the end, on p. 1295, the author, addressing the 'good reader,' says, 'I desire thee to take these my labours in good part, like as I have painfully to my great cost and charges, and not for hire, out of many old hidden histories and true records of antiquity, brought the same to light, and freely, for thy great commodity, bestowed them upon thee: so shalt thou encourage me to publish a larger volume and history of this island, princes of the same, and accidents of their times, which I have gathered, and is ready to the press, when God shall permit me.' Stow's 'Annals,' although of course mentioning the same facts, with many others, as his 'Summary,' is altogether a different work from that: even this edition of 1592 must contain at least ten times as much matter as the most extended edition of the 'Summary.' Another edition, also in 4to. and black letter, a copy of which is in the British Museum, is entitled 'The Annales of England; faithfully collected out of the most authenticall authors, records, and other monuments of antiquity; lately collected, since encreased, and continued from the first habitation untill this present year 1605; by John Stow, Citizen of London. Imprinted at London for George Bishop and Thomas Adams. Cum privilegio regiæ majestatis.' This edition has the dedication to Whitgift, dated 1600, already mentioned, and also a 'Preface or Address to the Reader,' which contains the greater part of the Dedication prefixed to the various editions of the 'Summary,' and inscribed to the lord mayor for the time being. In his Dedication to Whitgift the author states that his laborious collections have now at length grown into a large volume, 'which,' he says, 'I was willing to have committed to the press, had not the printer, for some private respects, been more desirous to publish Annals at this present;' and he afterwards expresses his hope of the archbishop's favourable acceptance of the present work, as but part of that which he 'intended in a more large volume.' In his Preface also he describes this edition of his 'Annals' as an abstract of a far larger work which he has gathered, and meant to have published; and at the end of the 'Chronicle,' on p. 1438, after soliciting as usual the reader's favourable acceptance of his labours, he adds, 'So shalt thou encourage me, if God permit me life, to publish or to leave to posterity a far larger volume, long since by me laboured, at the request and commandment of the Rev. Father Matthew Parker, Archbishop of Canterbury; but, he then deceasing, my book was prevented by printing and reprinting (without warrant or well-liking) of Rayner Wolfe's Collection, and other late comers, by the name of Raphael Holingshead his Chronicles.' We doubt if, with the exception of the continuation, there be almost anything in this edition of the 'Annals' which is not in the preceding edition of 1592. Nor does there appear to be much added to the portion of which Stow is the author in either of the editions published after his death by Howes, in folio, the first in 1615, the second in 1631. Of the latter, still in black letter, the full title is 'Annales, or a General Chronicle of England; begun by John Stow, and augmented with matters forraigne and domestique, antient and moderne, unto the end of this present year 1631, by Edmund Howes.' In his dedication to the king however Howes intimates that he had been no less than thirty years employed upon the work, and that he had undertaken and performed the task in consequence of his 'oath and promise made to the late most reverend prelate Doctor Whitgift, Lord Archbishop of Canterbury.' We do not find that he professes to have made use of any manuscript materials left by Stow.

Stow's other work, his 'Survey of London,' was first published, in a quarto volume, in 1598; and again, in the same form, with considerable additions, in 1603. After the author's death, a third edition, also in 4to., was published in 1618, by A. M. (Anthony Monday), who, according to Strype, 'made several additions (as he pretended) which, or much of which (as he hinted in his Epistle), he had formerly from Stow himself, who, while he was alive, delivered him some of his best collections, and used importunate persuasions with him to correct what he found amiss, and to proceed in perfecting a work so worthy.' A fourth edition, in folio, came out in 1633, professing on the title-page to be 'now completely finished by the study and labour of A. M., H. D. (Humphry Dyson), and others.' Strype gives C. J. as one of the contributors, meaning probably the C. I. whose signature is appended to the prefatory address to the reader. The next edition was that published by Strype, in 1720, in two folio volumes, each twice the size of the folio of 1633. Strype's additions indeed made the 'Survey,' for the greater part, a new work. The writer of the article on Stow in the 'Biographia Britannica' is, as far as we know, mistaken in his assertion (Note L.), that this edition was reprinted in 1756.

Stow, in various passages of his 'Annals,' claims the continuation of Holinshed's 'Chronicle' from 1576 to 1586, as his own handiwork. He appears to have at least supplied a great part of the materials for that portion of the work; but he is merely mentioned as one of several contributors in the Epistle to the Reader prefixed to the edition of 1587 by A. F. (Abraham Fleming), who besides takes to himself the credit of having digested the whole. In his 'Annals,' under the year 1400, Stow states that the edition of Chaucer published (by Speght) in 1560, was founded upon divers written copies corrected by him. Dr. David Powel, in his 'History of Cambria,' published in 1584, acknowledges that he derived important assistance from Stow, who supplied him with a considerable number of manuscript historians, of which he had made use. Stow had possessed himself of a large collection of curious and valuable manuscripts, some originals, some transcribed by his own hand; among the latter, the six volumes of Leland's 'Collectanea' (since printed by Hearne), which he sold to Camden for a life annuity of eight pounds a year.

The hard fate of Stow in his old age is well known. The laborious and acute investigator of antiquity, and faithful and graphic depictor of the manners and customs of his own time, was left by his countrymen, when he had reached his eightieth year, literally to beg his bread. Strype has given a letter from James I., referring to letters patent under the great seal, granted 8th May, 1603, authorising Stow to collect the voluntary contributions of the people throughout the greater part of the kingdom,* and also the actual brief or licence by which the same privilege was renewed to him the following year. The latter paper, in consideration of Stow having, 'for the good of the commonwealth, and posterity to come, employed all his industry and labour to commit to the history of chronicle all such things worthy of remembrance, as from time to time happened within this whole realm, for the space of five and forty years, until Christmas last passed (as by divers large and brief chronicles of his writing may appear), besides his

* This paper has been lately more correctly given from the original copy preserved in the Harleian Collection, by Mr. Bolton Corney, in his 'Curiosities of Literature Illustrated,' Greenwich, 1839, p. 40. The date of the letters patent referred to in the letter is there given the 8th of March (not May), 1603, which, according to the modern reckoning, would be March, 1604.

great pains and charge in making his book called his "Survey of London," wherein he spent eight years in searching out of antient records concerning antiquities both for London and Southwark,' and in consequence of his having forfeited the favour, and 'having left his former means, whereby he lived, only employing himself for the service and good of his country,' grants to him and his deputy, the bearer of the paper, licence for one year, to ask, gather, and receive the alms and charitable benevolence of all people in the counties and cities enumerated, and commands the authorities, at such times as Stow or his deputy shall come to any of their churches, or other places, to ask and receive the said gratuities, 'quietly to permit and suffer them so to do, without any manner let or contradiction.'

Stow died of the stone colic, on the 5th of April, 1605, and was buried in his parish church of St. Andrew Undershaft, where his monument, exhibiting his effigy, erected by his widow, is still to be seen. Strype says that he left four daughters, but whether any sons he could not learn.

It is stated by Mr. Corney, in his 'Curiosities of Literature Illustrated' (p. 41, note), that a memoir of Stow was then contemplated by John Gough Nichols, Esq., F.S.A.; but, as far as we are aware, it has not yet appeared.

STOW-ON-THE-WOLD. [GLOUCESTERSHIRE.]

STOWE. [BUCKINGHAMSHIRE.]

STRABISMUS. [SQUINTING.]

STRABO (Στράβων) was born at Amasia, in Cappadocia, before the Christian æra, but the time of his birth is unknown. His mother was the granddaughter of Lagetas, who was one of the two sons of Dorylaus, a skilful commander who had been employed by Mithridates Euergetes. (Strab., p. 477, 478, ed. *Casaub.*) Moaphernes, who had been employed by Mithridates Eupator, was an uncle of Strabo's father (p. 499), or (according to the true reading of Strabo's text) the uncle of his mother by the father's side. We are not informed who his father was. It has been observed that his name, Strabo, is the cognomen of Pompeius Strabo, the father of Pompey the Great, whence it has been conjectured that on his father's side there was some connection with the family of Pompey; but what this connection may have been, is purely a matter of conjecture. Strabo, the son, received a good education. He studied at Nysa, under Aristodemus; at Amisus, in Pontus, under Tyrannio; and at Seleuceia of Cilicia, under Xenarchus, who was a Peripatetic. He also visited Alexandria in Egypt, where he had the instruction of Boethus of Sidon, also a Peripatetic; and Tarsus, then a great school of learning, where he studied under Athenodorus, who was a Stoic. It thus appears that even during the course of his education Strabo must have been a considerable traveller, and his own work shows that he must subsequently have visited many places. Syria, Palestine, and Egypt, as far as the cataracts of Syene, were within the range of his travels. In Egypt he became acquainted with Aelius Gallus, who commanded a Roman expedition into Arabia, in the time of Augustus, and he visited in his company the vocal statue of Memnon at Thebes (p. 816). He also travelled in Crete, Northern Greece, and probably some parts of the Peloponnesus: he tells us that he saw Cleonae from the Acrocorinthus: but his remarks about Mycenae seem to show that he did not visit that part of the Peloponnesus at least (p. 377). He was personally acquainted with Italy, and he tells us that Elba, Corsica, and Sardinia are visible from the heights of Populonium (p. 223), from which it is a probable conclusion that he had seen those places from the Italian coast. It is also probable that he spent some time at Rome, where he would find materials for his geographical work.

There are various passages in his 'Geography' which indicate about what time they were written. In his sixth book (p. 288) he speaks of Germanicus and Drusus as still living; and in the thirteenth (p. 627) he speaks of Tiberius as the reigning emperor, and as having repaired the mischief done to Sardis by the great earthquake, A.D. 17. (Tacit., *Ann.*, ii. 47.) There are numerous other passages in this work in which he speaks of contemporary historical events, but perhaps none which can with certainty be referred to a later date than the great earthquake. In a passage of the fourth book (p. 206) he says that it was then the thirty-third year since the Norici had been reduced to obedience by Tiberius and Drusus, which took place about B.C. 15; according to which Strabo was writing his fourth book in the year A.D. 18.

Strabo's 'Geography' is mentioned by few antient writers: he is cited by Marcianus of Heraclea, Athenaeus, and Harpocration (Λευκάς, Αἰγαῖον); but Pliny, who might frequently have cited him in the geographical part of his work, never mentions his name; nor does it occur in Pausanias. He is mentioned by Josephus and by Plutarch, not as a geographer, but as an historical writer.

Very different opinions have been given of Strabo's geographical work. That he was deficient in mathematical knowledge is evident, and his accuracy in many cases is at least doubtful. To form a proper judgment of him, we must ascertain what he proposed his work to be, which may be collected from various passages. His work was to be practical, that is, adapted to the use of persons of a certain amount of education, and particularly personages engaged in administration. He says that a 'man who reads his work ought not to be so ignorant as never to have seen a sphere or the circles marked on it;' and he goes on to say, that a man who is ignorant of these and other like matters, which he has enumerated, and which belong to the elementary parts of knowledge, cannot understand his work. 'His work,' he says, 'is, in a word, for universal use, political and profitable to all, just as history is' (p. 12, 13); and 'as he had written an historical work (ὑπομνήματα ἱστορικά), useful, as he supposed, both for ethical and political philosophy, he determined to add to it a geographical work, which was of a like kind, and addressed to the same class of men, and chiefly to those in power; and, as in the former work, only what related to distinguished men and to distinguished lives was recorded, and things trivial and mean were omitted; so in his geographical work he should dwell only on things which were of note and of importance, and things in which there was something useful for example, and worth recording, and agreeable.' From this it appears that Strabo neither designed a mathematical treatise, nor an enumeration of astronomical positions, nor a treatise on the physical character of countries. His design was to write something which should give an educated man a general notion of the earth's surface, its political divisions, the chief peculiarities of each, and so much of its history as would enliven and explain his geographical description.

Accordingly Strabo produced a work which contains a great mass of useful information, but is not strictly a geographical work, and though systematic according to his notion of system, it does not deserve the name of a system of geography. Though he resided a long time at Alexandria, he derived little advantage from the labours of the geographers and astronomers of that school for the correction of positions and fixing the bearings of places with respect to one another, or for determining the general form of the regions which he describes. His taste indeed was for other studies than those which belong to the geographer.

The first two books of Strabo contain his general geography. In the first book he treats of the advantages of the study of geography, and discusses the geographical knowledge of Homer, which he rates highly. He then mentions the old geographers, as Hecataeus, Democritus, Eudoxus of Cnidos, and Ephorus of Cumae; and the more recent geographers, Eratosthenes, Hipparchus, Polybius, and Posidonius. He passes a critical judgment on the first two books of Eratosthenes, which leads him to various discussions, and to observations on the changes which the earth's surface has undergone. In the second book he extends his criticism to the third book of Eratosthenes, and to the three books of Hipparchus. He also discusses the merits of Posidonius and Polybius. Strabo has thus preserved many passages of the Greek geographical writers; but the author's judgment is often prejudiced and inaccurate. He severely criticises Hipparchus, and points out many of his errors, particularly as to the latitude of places. The latter part of the second book treats of the preliminary knowledge which the geographer requires. Strabo was acquainted with the fact of the spherical figure of the earth; and he determines the boundaries of the habitable part of it. The world is divided by the equinoctial circle into the northern and the southern hemispheres. The habitable portion is bounded on the north by a parallel of latitude which passes through Ierne (Ireland), and on the south by the parallel which passes through the Cinnamon country. The parts to the north of the first parallel are not habitable on account of cold, and those to the south of the second parallel are uninhabited owing to excessive heat. He follows Eratosthenes in his measurements, and compares them

with those of Hipparchus and Polybius. The habitable world (*οἰκουμένη*) is surrounded by water, and the Caspian Sea is a gulf of the Northern Ocean, a mistake which he might have corrected by the aid of Herodotus. The length of the habitable world is about double its breadth.

The third book contains the description of the Spanish Peninsula and the Balearic Islands; his principal authorities are Artemidorus, Posidonius, and Polybius. The fourth treats of Gallia, Britain, the Alps, and the tribes which inhabited the Alps, and the valleys belonging to that mountain-system: in general he follows the description of Cæsar, and he also used Artemidorus and Polybius, and probably the work of Aristotle on Political Constitutions, for his account of Massilia (Marseille): his description of Britain is exceedingly meagre; in treating of Thule he gives some account of Pytheas, but rejects his authority. The fifth and sixth books contain the description of Italy, Sicily, and the adjoining islands: he had probably seen a large part of these countries himself; yet he makes great use of Polybius, Posidonius, Ephorus, Eratosthenes, and many other writers: in treating of Corsica and Sardinia, he quotes the 'Chorographus,' without saying who is intended by the term: it has been suggested that the word has reference not to any particular individual, but to the results of the commission under the direction of Agrippa which made a survey of the empire: it has also been conjectured that Agrippa himself is meant by the Chorographus. In the seventh book Strabo treats of the countries on the Danube, and the parts included between the Danube, the Adriatic, and the Black Sea. the parts which treat of Macedonia and Thrace are lost, and in their place we have a scanty epitome. Strabo's authorities for this part of his work seem to have been very defective. The eighth, ninth, and tenth books contain his description of Greece and the Islands, in which he makes great use of Homer: Ephorus, Polybius, Posidonius, Hipparchus, Artemidorus, and Timosthenes, are also his authorities, in addition to many other writers. With the eleventh book Strabo begins his description of Asia, as to the extent and dimensions of which his notions are very inaccurate. He divides it into two main portions, determined by the range of Taurus. The western portion comprises the countries between the Tanais, Palus Maeotis, the Black and the Caspian Seas; the countries east of the Caspian, bordering on India; and Media, Armenia, and Cappadocia, to the Halys: these are described in the eleventh book. In the twelfth and following books he treats of Asia west of the Halys and the adjoining islands. His authorities for the eleventh book are, among others, Artemidorus, the historians of the Mithridatic wars; Metrodorus of Scepsis; and Patrocles, the admiral of Seleucus and Antiochus, for the account of the Oxus and Jaxartes. The twelfth book contains the description of Cappadocia, Pontus, Paphlagonia, Bithynia, Galatia, Lycaonia, Isauria, Pisidia, Mysia, and Phrygia, a great part of which is founded on his own personal knowledge. The thirteenth and fourteenth books conclude the description of Asia west of the Halys; and comprehend also the islands of Lesbos, Samos, Chios, Rhodes, and Cyprus. His description of the Troad, in the thirteenth book, is mainly founded on Homer; but he also uses Eudoxus, Charon, Scylax, and Ephorus. A great number of other writers were also used for the description of the several countries and places included in these two books. In the fifteenth book he passes to the description of the other portion of Asia, which is determined by the Taurus; and he first treats of the southern parts of the continent. In his description of India he chiefly follows Eratosthenes and the historians of Alexander, particularly Patrocles and Aristobulus. His notion of the form of India was entirely false, and he knew nothing of the great southern peninsula; but he speaks at some length of the customs and institutions of the people. After India he describes the Persian empire, comprehending under the general name of Ariana (Iran) the country bounded on the east by the Indus, and on the west by a line drawn from the Caspian Gates to the mouth of the Persian Gulf. Nearchus and Onesicritus are his authorities for the description of the coast: for other parts he uses Aristobulus, Eratosthenes, and Polyclitus. The sixteenth book contains the remainder of Asia: his authorities are generally the same as for the southern and eastern parts of Asia, with the addition of his own observations in Syria. The seventeenth book contains the description of Libya (Africa), and concludes with a brief sketch of the division of the Roman empire into provinces: Eratosthenes is his principal authority, but he also uses Agatharchides and Herodotus.

The text of Strabo is often corrupt, and there are many defective passages. There is extant an epitome, or Chrestomathia, of the whole work, which is referred to the tenth century A.D., which is sometimes useful in correcting the text. There are also extant various other extracts from the geography of Strabo. The historical work (*ὑπομνήματα ἱστορικά*) of Strabo, which he mentions in a passage already quoted, is lost: it was a continuation of Polybius, and extended at least to the death of Julius Cæsar.

Strabo first appeared in a Latin version in 1472. The first edition of the Greek text was printed by Aldus, at Venice, in 1516, fol. The edition of Isaac Casaubon, Geneva, 1587, folio, contains the translation of Xylander: this edition was reprinted after Casaubon's death, at Paris, 1620, folio, with his last corrections. Siebenkees undertook a new critical edition, for which purpose he collated several MSS.; he only lived to complete the first volume, which contains the first six books: this edition was finished by Tzschucke, and was published at Leipzig, 1796-1811, 6 vols. 8vo. Probably the best text of Strabo is by Coray, Paris, 1815-1819, 4 vols. 8vo., which has an index, but no translation. The 'Chrestomathia' is printed in Hudson's Minor Geographers, and in the editions of Almeloveen, and of Falconer. There is a French translation of Strabo in 5 vols. 8vo. (1805-1819), by La Porte du Theil, Coray, and Gossellin; the sixteenth and seventeenth books are by Letronne. Strabo was translated into Italian by Ambrosoli, Milan, 1828, 4 vols. 8vo. and 4to. The valuable German translation of Groskurd, in 3 vols. 8vo. (1831-1834), is founded on a corrected text, and is accompanied with critical notes and explanations.

A full account of the editions, translations, and various works in illustration of Strabo is contained in Hoffmann's 'Lexicon Bibliographicum.'

STRADA, or STRADA'NUS, JOHN, was born in the year 1536, of an illustrious family, at Bruges, where he studied the art of painting. He went while very young to Italy, and soon acquired so much proficiency and reputation, as to obtain employment at Florence in the palace of the duke, Cosmo I., and in those of several of the nobility. From Florence he went to Rome, where he devoted himself with the greatest ardour to the study of the antique and the works of Raphael and Michael Angelo. By this means he so much improved his taste, knowledge of composition, and correctness of design, that he was ranked among the most eminent artists of his time; and before he left Rome he was employed in the pope's palace, in conjunction with Daniel da Volterra and Francesco Salviati.

At Naples and other cities of Italy to which he was invited, he executed many considerable works in fresco and in oil; but he fixed his residence in Florence, in which city there are still some fine performances of his; the most celebrated is the Crucifixion, which is a grand composition, with numerous figures larger than life, and near the cross are the Virgin, St. John, and Mary Magdalen.

Though he chiefly painted subjects from sacred history, he was fond of painting animals, hunting parties, and sometimes battles, all of which he executed in a noble style, and with great spirit. It is not possible to reconcile the statements of authors respecting the birth and death of Strada: Sandrart and others say he was born in 1536, and died in 1604, aged 68. This is probably correct. De Piles and Resta say he was born in 1527, and died in 1604, aged 77. The authors of the 'Abrégé de la Vie des Peintres' say that he died at the age of 82; yet they fix his birth in 1536, and his death in 1605, which would make him only 69 years of age.

(Pilkington; Fuseli; Bryan.)

STRADA, FAMIA'NO, born at Rome in 1572, entered the order of the Jesuits, and became professor of rhetoric in the Gregorian college at Rome, where he spent the greater part of his life, and where he died in 1649. He wrote 'Prolusiones,' or Latin essays, upon rhetoric and literature, which were admired at the time. In these essays the author comments upon several of the Roman classical writers, and he introduces his own imitations of their style. He speaks very unfavourably of Tacitus, whom he accuses of malignity, impiety, and want of veracity, though he praises his style. But the work for which Strada is remembered, is entitled 'De Bello Belgico ab Excessu Caroli V. ad Annum 1590,' being a history of the revolt and war of the Netherlands against Spain, which he wrote in Latin, about the same

time as his contemporary Bentivoglio wrote the history of the same war in Italian. Strada brought his narrative down to the year 1590, and the work was continued by two other Jesuits, fathers Dondini and Galluzzi, who wrote the sequel as far as the year 1609: their compositions however are very inferior to Strada's in style. It appears that Strada undertook his work at the desire of the Farnese family, one of whose members, Alessandro Farnese, duke of Parma, became illustrious in the wars of Flanders, as commander of the Spanish armies. The history of Strada is not without merit, though it can hardly be expected to be quite impartial. His rival historian Cardinal Bentivoglio was also biased in favour of Catholic Spain against the Protestant Netherlanders, yet he wrote with considerable freedom, and the work of the Cardinal is generally preferred to that of the Jesuit, but this preference may be partly attributed to the circumstance that Strada's work is written in a dead language.

STRADELLA, ALESSANDRO, a composer much celebrated in musical history, was born at Naples, about the middle of the seventeenth century. His works, most of which are to be found in the British Museum and in the library of Christchurch, Oxford, are chiefly of a miscellaneous kind, consisting of airs, duets, cantatas, madrigals, &c. One oratorio and one opera comprise the whole of his dramatic compositions that Dr. Burney's diligent search enabled him to discover. The former—*San Giovanni Battista*—is highly extolled by the musical historian, who has, in his fourth volume, given a duet from it, as a specimen of the whole, but in the *Fitzwilliam Music* is a quintet from the same of a far superior order. It seems to be agreed that the study of his works contributed largely in forming the taste of many great composers,—of our own Purcell, of Clari, Steffani, A. Scarlatti, and Pergolesi, and this alone is sufficient to bestow on him a lasting reputation.

The personal history of Stradella is so interesting, so romantic when fully narrated, that a brief sketch of it will, we trust, not be thought obtrusive here. It has recently been represented in a dramatic form on the French stage.

He was not handsome, but remarkable for the symmetry of his form, for his wit and polished manners, and these, added to his exquisite style of singing, made his company desirable in the highest circles. At Venice he was engaged by a nobleman to instruct a young lady of high birth, named Hortensia, who, notwithstanding her family rank, submitted to live with the noble Venetian in criminal intimacy. After a time the fascinating qualities and accomplishments of her teacher raised a new flame in her bosom. The passion was mutual, the lovers were married, and fled to Rome, whither they were pursued by two assassins, engaged by the Venetian to punish the inconstancy of his mistress and avenge the injury his pride had sustained. These found the happy couple in the church of San Giovanni Laterano, and they determined to carry their design into execution as the fugitives retired, in a dark evening, at the conclusion of the sacred service. But while waiting the favourable moment, they heard the musician sing, and were so overcome by the charms of his voice and strains, that, confessing to him what had been their object, they declared their determination to abandon it. The intended victims immediately retired to Turin. There they were pursued by two other hired murderers, and though taken under the protection of the Duchess of Savoy, and lodged in her palace, Stradella received three stabs in his breast, and the assassins found a sanctuary in the hotel of the French ambassador, who refused to surrender them. The wounds, though most dangerous, did not prove mortal, and as a year elapsed after the recovery of the sufferer, and no fresh attempt on his life was made, he considered himself secure for the future. But the resentful Venetian only awaited a more certain opportunity for gratifying his unquenchable revenge. Stradella accepted an engagement at Genoa, to compose an opera, whither he went with his wife. Their enemy, informed of this movement, followed them by the agents of his unrelenting revenge, who, rushing into their chamber, stabbed both of them to the heart. This event Walther, in his Lexicon, fixes in the year 1670: but Dr. Burney shows that it must have occurred some years later.

STRAFFORD, THOMAS WENTWORTH, afterwards EARL OF, was born in Chancery-lane, London, on the 13th of April, 1593. He was the eldest son of Sir William Wentworth, of Wentworth Woodhouse, in the county of York, where his family are said to have been settled since the time of the Conquest. His family was one of the most opulent as well as antient of the class known in England under the name of gentry, and had frequently intermarried with the higher aristocracy. The estate which Wentworth inherited from his father was worth 6000*l.* a year, a very large sum at that time, probably equal to more than three times the amount in the present day. (Strafford's *Letters and Dispatches*, vol. ii., pp. 105, 106, folio edition, London, 1739, and Dr. Knowler's *Dedication* prefixed to them.) He received part of his education at St. John's College, Cambridge. In 1611 he married the Lady Margaret Clifford, the eldest daughter of Francis, earl of Cumberland. The accuracy of this date, as that of his first marriage, given by his friend Sir George Radcliffe, appears to be established by a letter dated 11th January, 1611, from Sir Peter Frechevile to his father Sir William Wentworth: although the compilers of his Life in the 'Biographia Britannica' have chosen, in direct opposition to the statement of Radcliffe, the old and intimate friend of Wentworth, to place his marriage after his return from the Continent, towards the end of 1612 (by the old mode of reckoning, according to which the legal year began on the 25th of March, but by the new about the beginning of 1613), instead of in 1611, before his going abroad.

The same letter also shows that he was from his early years of studious and regular habits. He appears to have taken almost as much pains as Cicero recommends for the education of an orator. Sir George Radcliffe informs us that the excellence possessed by him in speaking and writing he attained 'first by reading well-penned authors in French, English, and Latin, and observing their expressions; secondly, by hearing of eloquent men, which he did diligently in their sermons and public speeches; thirdly, by a very great care and industry which he used when he was young in penning his epistles and missives of what subject soever but above all, he had a natural quickness of wit and fancy, with great clearness of judgment, and much practice, without which his other helps of reading and hearing would not have brought him to that great perfection to which he attained. I learned one rule of him,' adds Sir George, 'which I think worthy to be remembered; when he met with a well penned oration or tract upon any subject or question, he framed a speech upon the same argument, inventing and disposing what seemed fit to be said upon that subject before he read the book; then reading the book, compare his own with the author, and note his own defects, and the author's art and fullness; whereby he observed all that was in the author more strictly, and might better judge of his own wants to supply them.' (Strafford's *Let. and Disp.*, vol. ii., p. 435.)

In some of Strafford's earlier letters, particularly those to Sir George Calvert, principal secretary of state in the time of James I., there is, though no marks of profound scholarship, a somewhat pedantic display of trite Latin quotations. From these however, though we may judge so far of the extent of Strafford's scholarship, it would be incorrect to estimate his abilities, for they are mostly confined to his early letters, and, among them, to his letters to courtiers.

Upon his early habits still further light is thrown by some advice which he gives to his nephew Sir William Savile, in a letter dated 'Dublin Castle, 29th September, 1633.' Advising him to 'distrust himself and fortify his youth by the counsel of his more aged friends before he undertakes anything of consequence:' he adds, 'it was the course that I governed myself by after my father's death, with great advantage to myself and affairs, and yet my breeding abroad had shown me more of the world than yours hath done; and I had natural reason like other men, only I confess I did in all things distrust myself, wherein you shall do, as I said, extremely well if you do so too.' (*Let. and Disp.*, vol. i., p. 169.)

The letter from which the above quotation is made contains so much good advice, so well and so weightily expressed, that it may bear a comparison with Burleigh's celebrated 'Advice to his Son:' the resemblance in some passages is striking. With respect to the greater part of this advice, particularly what regards economy and regularity in the management of his private affairs, temperance in drinking, and abstinence from gaming, it was the rule by which Wentworth shaped his own conduct, and to which, according to Radcliffe, he strictly adhered. The part of the advice to which he himself least adhered was that recommending calmness and courtesy of demeanour; for even his most intimate friend Sir George Radcliffe admits that 'he

was naturally exceeding cholerick,' and the actions of his life show that in that particular he was never able thoroughly to subdue nature.

In the same year in which he was married, Wentworth went into France, having previously been knighted. He was accompanied by the Rev. Charles Greenwood, fellow of University College, Oxford, as his 'governor,' or travelling tutor, for whom he entertained the greatest respect and regard to the end of his life. In February, $161\frac{3}{4}$, he returned to England. He was returned and sat for the county of York in the parliament which began April 5th, 1614. Radcliffe's account as to this date, though rejected by the writers in the 'Biographia Britannica,' and Mr. MacDiarmid, is confirmed by Browne Willis's 'Notitia Parliamentaria,' vol. iii., p. 169: 'Co. Ebor. Jo. Saville, kt., Thomas Wentworth, kt. and bart., anno 12 Jac. I., began April 5, 1614, and continued till June 7, and was then dissolved.' During this short parliament, which continued only two months, Wentworth does not appear to have spoken. Mr. Forster, his latest biographer, says that he has examined the Journals, and finds no trace of Wentworth's speaking on either side in the great struggle that was then going on. (*Life of Strafford*, in the *Cabinet Cyclopædia; Lives of Eminent British Statesmen*, vol. ii., p. 197.)

In 1615 Wentworth was appointed to the office of custos rotulorum for the west riding of the county of York, in the room of Sir John Savile; an office of which Savile attempted to deprive him about two years after, through the influence of the favourite, the duke of Buckingham, but without success, though he succeeded afterwards. The result was a feud between Wentworth and the Saviles, the father and son, Sir John Savile the younger, afterwards Lord Savile.

In 1621 Wentworth was again returned to parliament for the county of York; and this time he brought in Sir George Calvert, one of the secretaries of state, along with him. In Michaelmas term, he removed his family from Wentworth Woodhouse to London. He took up his abode in Austin Friars, where in 1622 he had a 'great fever.' When he began to recover, he removed, about July, to Bow, where shortly after his wife the lady Margaret died. On the 24th of February, $162\frac{4}{5}$, he married the lady Arabella Holles, a younger daughter of the earl of Clare, a lady, observes Radcliffe, 'exceeding comely and beautiful, and yet much more lovely in the endowments of her mind.'

Although Wentworth had not taken a very prominent part in the proceedings of parliament, still he was considered to have acted with the party that opposed the court, as appears from the fact of his being, on the eve of the calling together of a new parliament, among the number of those whom Buckingham attempted to disable from serving, by having them pricked sheriffs of their respective counties. In November, 1625, Wentworth was made sheriff of Yorkshire. A passage from one of his letters at this time shows that he was never inclined to go the lengths that some others did in resistance to the royal prerogative. (Strafford's *Letters and Disp.*, vol. i., p. 33.)

In May, 1627, he was committed a prisoner to the Marshalsea by the lords of the council for refusing the royal loan: and about six weeks after, his imprisonment was exchanged for confinement at the town of Dartford in Kent, from which place he was not to go above two miles. About Christmas he was released; and shortly after the third parliament of Charles began, in which Wentworth served as knight for Yorkshire. Wentworth had now resolved to make the court party more aware of the extent of his talents than they yet appeared to be. On the discussion of the general question of grievances, he spoke with an ability and spirit which proved to them that he might turn out such an enemy, that he was worth having as a friend. It has been usual to speak of Wentworth as an apostate. But he never appears to have been at heart on the popular, or rather, the parliamentary side. His whole conduct both before and after he became the king's minister shows that he considered the general movement in modern Europe to be not towards democracy, but towards the establishment of absolute monarchy. The several springs of Wentworth's conduct are now fully laid bare in a manner that they could hardly be to his contemporaries, and in a manner that few men's have ever been to after-ages, by the publication of the two large folio volumes of his 'Letters and Dispatches,' one of the most valuable collections of papers, both in a political and historical point of view, ever made public. In that collection there are two letters (Strafford, *Let. and Disp.* vol. i., pp. 34, 35), to Sir Richard Weston, chancellor of the exchequer, containing very unequivocal overtures, the non acceptance of which at the time would seem to have produced the indignant outbreak of patriotic eloquence above alluded to.

In June, 1628, the parliament ended. In July Sir Thomas Wentworth, having been reconciled to Buckingham, was created Baron Wentworth. The death of Buckingham soon after removed the only obstacle to higher honours. In Michaelmas term he was made Viscount Wentworth, Lord President of the North, and a privy counsellor.

The establishment of the Council of the North originated in the frequent northern rebellions which followed Henry VIII.'s suppression of the lesser monasteries, and extended over the counties of York, Northumberland, Cumberland, Westmoreland, and Durham. The commission, though apparently only one of oyer and terminer, contained a clause authorising the commissioners to hear all causes real and personal, when either of the parties was poor, and decide according to sound discretion. This clause was declared by all the judges to be illegal. James issued a new commission, by which the commissioners were not ordered to inquire 'per sacramentum bonorum et legalium hominum,' or to be controlled by forms of law, but were merely referred to certain secret instructions which were sent down to the council. Against this however the judges had the courage to protest, and to issue prohibitions on demand to the president and council; and the instructions were ordered to be enrolled, that the people might have some chance of knowing them.

Dr. Knowler, the editor of the 'Strafford Papers,' in the adulatory dedication of them to his patron, the grandson of the earl of Strafford, gravely observes that 'Sir Thomas Wentworth, who was a true friend to episcopal government in the church, and to a limited monarchy in the state, could have no reason, when the Petition of Right was granted, to refuse to bear his share of toil and pains in the service of the public, or to withstand the offer of those honours his majesty was graciously pleased to make him, especially when it gave him an opportunity of setting an example of a wise and just and steady administration.' Wentworth's acceptance of this office of president of this council was a flagrant violation of the fundamental principle of the Petition of Right. His career in the office too did not belie the promise of its acceptance. One of his first acts was to declare that he would lay any man by the heels who ventured to sue out a prohibition in the courts at Westminster. (Rushworth, vol. ii., p. 159.) And one of the judges (Vernon), who had the courage to resist these encroachments on the ancient laws of the land, Wentworth tried hard to have removed from his office. (Strafford, *Let. and Disp.*, vol. i., pp. 129, 130.) Indeed, like his friend and coadjutor Laud, Wentworth never let slip an opportunity of expressing his bitter dislike of the interference of the judges and common lawyers with his scheme of governing, not by the laws of England, but according to 'sound discretion.'

In January, 1631, Wentworth was made lord deputy of Ireland. The principle on which he set about governing there was in substance the same as that of his government in the presidency of York. 'These lawyers,' he writes to the lord marshal, 'would monopolise to themselves all judicature, as if no honour or justice could be rightly administered but under one of their bencher's gowns.' (Strafford, *Let. and Disp.*, vol. i., p. 223.) And he adds, a line or two after, 'Therefore if your lordship's judgment approve of my reasons, I beseech you assist me therein, or rather the king's service, and I shall be answerable with my head.'

It is remarkable how frequently he alludes to this last as the test of the soundness of the policy of his measures. They were in the end so tested, and being found wanting, he was taken at his word; he was called upon to pay, and paid the forfeit. One of the principal means by which Wentworth sought to squeeze money out of the people of Ireland was by holding a parliament.

Wentworth's political economy was not very sound, yet he saw far enough to discover that to enrich the king, the way was, to begin by enriching the people. 'For this is a ground,' he says, 'I take with me, that to serve your majesty completely well in Ireland we must not only endeavour to enrich *them*, but make sure still to hold them dependent upon the crown, and not able to subsist without

us. (Strafford's *Let. and Disp.*, vol. i., p. 93.) But the plan he proposed does not seem certainly very well adapted for enriching the people. 'Which will be effected,' he proceeds, 'by wholly laying aside the manufacture of wools into cloth or stuff there, and by furnishing them from this kingdom; and then making your majesty sole merchant of all salts on that side; for thus shall they not only have their clothing, the improvement of all their native commodities (which are principally preserved by salt), and their victual itself from hence (strong ties and enforcements upon their allegiance and obedience to your majesty); but a means found, I trust, much to advance your majesty's revenue upon salt, and to improve your customs. The wools there grown, and the cloths there worn, thus paying double duties to your crown in both kingdoms; and the salt outward here, both inward and outward there.' He thus sums up the advantages of the measures proposed:—'Holding them from the manufacture of wool (which, unless otherwise directed, I shall by all means discourage), and then enforcing them to fetch their clothing from thence, and to take their salt from the king (being that which preserves and gives value to all their native staple commodities), how can they depart from us without nakedness and beggary? Which in itself is so weighty a consideration, as a small profit should not bear it down.' (*Let. and Disp.*, vol i., p. 193.)

In one particular he did benefit Ireland. At his own risk he imported and sowed a quantity of superior flax-seed. The first crop having succeeded, he next year laid out 1000*l.* on the undertaking, set up a number of looms, procuring workmen from France and Flanders, and sent a ship to Spain freighted with linen at his own risk. Thus began the linen manufacture of Ireland, which in some measure verified Wentworth's prediction that it would greatly benefit that country. (Strafford, *Let. and Disp*, vol. i., p. 473.)

Wentworth appears to have been of very infirm health, which, taken with the general course of his education and his position in society, will in part account for the acerbity and irritability of temper, and the impatience of any opposition to his will, which throughout his career involved him in so many personal quarrels. The number of powerful personal enemies which Wentworth thus arrayed against himself appears to us to be a proof of the want of real political talent of a high order. A really wise politician, such as Oliver Cromwell for example, does not raise up such a host of powerful personal enemies. Laud gives a good hint about this in one of his letters. 'And yet, my lord,' he says, 'if you could find a way to do all these great services and decline these storms, I think it would be excellent well thought on.' (Strafford, *Let. and Disp.*, vol. i., p. 479.)

In 1639 Charles raised Wentworth to the dignity of an earl, which he had in vain solicited formerly. He was created earl of Strafford and baron of Raby, and invested with the title of lord-lieutenant, or lieutenant-general of Ireland—a title which had not been borne since the time of Essex.

In 1640 the earl of Northumberland being attacked by severe illness, the king appointed Strafford in his place, to the command of the army against the Scots. He does not appear to have performed anything here to make good either his own high pretensions or the character for valour given him by some writers. Of his impeachment at the opening of the Long Parliament, Clarendon gives the following account:—'It was about three of the clock in the afternoon, when the Earl of Strafford (being infirm and not well disposed in health, and so not having stirred out of his house that morning), hearing that both houses still sate, thought fit to go thither. It was believed by some (upon what ground was never clear enough) that he made that haste there to accuse the Lord Say, and some others, of having induced the Scots to invade the kingdom; but he was scarce entered into the house of peers, when the message from the House of Commons was called in, and when Mr. Pym at the bar, and in the name of all the Commons of England, impeached Thomas, earl of Strafford (with the addition of all his other titles), of high treason.'

In the article PYM we have shortly adverted to the trial of the Earl of Strafford for high treason. To the remarks made there we may add that, though it was not to be supposed or expected that the Statute of Treasons of Edward III. (25 Edward III., st. 5, c. 2), being made to protect the king, not the subject, would provide specially for the punishment of such attempts as those of Strafford; it does nevertheless appear that Strafford was punishable for having become the instrument for administering the government of the Council of the North, carried on in direct violation of the Petition of Right, which during the time of Strafford's being president of that council was the law of the land. However the Commons changed their course and introduced a bill of attainder, which was passed on the 21st of April, in the Commons, and soon after in the Lords. The king with tears in his eyes and other demonstrations of weakness characteristic of him signed a commission for giving the royal assent to the bill, and then made some feeble and unavailing efforts to save the life of his obnoxious minister. 'The resort to the bill of attainder,' observes Mr. Forster (*Life of Strafford*, p. 404), 'arose from no failure of the impeachment, as has been frequently alleged, but because in the course of that impeachment circumstances arose which suggested to the great leader of the popular cause the greater safety of fixing this case upon wider grounds. Without stretching to the slightest extent the boundaries of any statute, they thought it better at once to bring Strafford's treason to the condemnation of the sources of all law.'

Strafford was beheaded on Tower Hill on the 12th of May, 1641. In his walk from the Tower to the place of execution his step and manner are described by Rushworth as being those of 'a general marching at the head of an army, to breathe victory, rather than those of a condemned man, to undergo the sentence of death.' Within a few weeks after his death, the parliament mitigated the penalties of their sentence to his children. In the succeeding reign, the attainder was reversed, and his son was restored to the earldom.

STRAIGHT, STRAIGHT LINE, PLANE. There is no occasion to define a straight line as matter of information; so that we have here only to consider the definitions which have been given and their relative merits, taking them as attempts to produce a mathematical description of straightness.

There are three attempts at definition of a straight line; by Plato (or one of his immediate school), by Archimedes (as is said), and by Euclid. The moderns have repeated these various forms, but have not, to our knowledge, ever succeeded in producing a definition entirely new which did not contain the defects of one or other of the three just mentioned.

The Platonic definition, according to Proclus, is as follows:—'A straight line is that of which the middle parts hide (ἐπιπροσθεῖ) the extremities;' a physical definition, owing its truth to the circumstance of the rays of light proceeding in straight lines, and involving the notion of straightness as a part of its own explanation. This definition has been little if at all used by geometrical writers.

Archimedes defines a straight line as the shortest distance between two points, or at least this definition is often attributed to him, but not correctly. It is one of his postulates in the book on the Sphere and Cylinder, that of all lines drawn between two points the least is that which is straight: but he is too well judging a geometer to assign such a property as a definition. The Arabs substituted the shortest-distance description for the definition in Euclid, and accordingly our earlier editions of Euclid do the same; nor was this flaw removed until 1505, when Zamberti translated Euclid from the Greek. It has been often supposed that this shortest-distance definition is good as a definition, though not proper for a pupil in geometry, an opinion from which we must dissent: for how is it known to those who are yet to learn what a straight line is, whether there can be a shortest distance? That is, how is it known that there are not many distances between two points, on different lines, which are severally shorter than any other distance, and equal to one another? The answer is, no doubt, that the mind has a perfect conception of the impossibility of such a thing; and the rejoinder is—yes, because the mind has a perfect conception of a straight line: that is to say, the definition is only saved from causing confusion by its own uselessness. Again, the supposition that measurement of distances on all manner of curves is to be a preliminary to one of the definitions of a science which treats no curve but the circle, and does not succeed, by reasons of certain limitations of process, in measuring distance even on that one, is an incongruity.

Euclid defines a straight line to be that which lies evenly (ἐξ ἴσου κεῖται) between its extreme points. The words ἐξ

ἴσου have been translated *ex æquo* by Barocius, *ex æquali* by Zamberti, *equally* by Billingsley (taking some of the oldest translations as specimens). The definition wants precision, but the meaning is obvious. Two points being given, the surrounding space may be viewed in all manner of relations to those two points, as above or below, right or left, &c. The straight line which joins the two points is that which is not more related to one of these notions than to any other; and throughout its whole length takes an even course, without a possibility of being claimed, so to speak, by any one of the surrounding parts of space rather than by any other.

In making such a definition Euclid is well aware that he cannot rest any conclusion upon it, and that in the postulate that two straight lines cannot inclose a space lies all his power of producing a theorem. Why then, it may be asked, does he introduce a definition at all? Why not give the reader to understand that a straight line is a notion universally understood and incapable of definition in simpler terms? To these questions the answer may be twofold. In the first place, he is not answerable for the genius of any language but his own, and it is very possible that to a Greek commencing geometry, εὐθεῖα might be a hard word, and ἐξ ἴσου κεῖται a real explanation; in which case his definition is defensible until it can be shown that he might have chosen a better one. We are not to judge of the force of the last-quoted words from the *ex æquo* of the middle Latin, or the *evenly* or *equally* of the English. Secondly, he is evidently, in his first definitions, recalling, and not instilling, notions: he is proceeding with his reader as by words to which both attach a conception, and he tries these words for use by ascertaining that both parties agree on such circumlocution as can be substituted for them.

The greatest defect of Euclid's definition, since it applies even to the view just taken of its intent, is the want of words signifying that ἐξ ἴσου refers equally to *all* adjoining parts of space: Euclid is thinking too much of a plane before he has defined a plane. Suppose, for instance, a sphere, and that lines on a sphere only are contemplated: the line which joins two points ἐξ ἴσου with reference to all adjacent parts of that sphere is not a straight line, but an arc of a great circle.

Is it possible, taking such allowances as Euclid sanctions in the use of figure, to give what shall be, whether difficult or not difficult, capable of use or not capable, a just definition of a straight line? We think it is, as follows:—The Greek geometer implicitly allows (i. 4) a TRANSLATION of figure without change of form or properties: from this, by first defining the plane, a definition of the straight line may be proposed, which we bring forward, not for any value which it has, but because the stipulations of geometry are better understood by consideration of cases proposed for acceptance or rejection, than by any other method.

1. Let two points (A and B) be said to be at the same *distance* from a third (C), when A and C being joined by *any* line, the line CA can be translated, C remaining fixed, so that A shall be brought to coincide with B.

2. A plane is a surface any point of which is equally distant from two given points.

3. A straight line is the intersection of two planes.

In the debates of the normal school, which were taken down in shorthand, and published in 1800, is a discussion on this subject. Lagrange presiding, Fourier, then one of the pupils, proposed the preceding second and third definitions, but without assigning a definition of equidistance independently of the straight line. He also proposed as the definition of a straight line the locus of a point which is equidistant from three given points; which is faulty, inasmuch as the three given points should not be in one straight line, which cannot be supposed until the straight line is defined. Lagrange admitted the rigor of the definition, but considered that it failed in presenting a sensible image of the thing defined. Another of the pupils however insisted that the idea of distance involved that of a straight line, which is true of distance as a quantity, though not necessarily so of equidistance as a relation.

Colonel Thompson proposes to define a straight line as one which being turned about its extreme points suffers no change of place. Lagrange, in the debate above alluded to, suggested the same notion. This definition, we think, offers the most tangible illustration of that of Euclid. Let the two extremities of the intended straight line be situated in a solid; and let them remain fixed in space while the solid takes such motion as, under that condition, it is capable of. The straight line, the line which lies ἐξ ἴσου with regard to the extreme points, then remains fixed. For if any part of it moved, there would be in every position a relation to adjoining parts of space, which would be in a state of continual change. The connexion between this definition by rotation and that of Euclid might require more development to render it as clear as possible: but we think the student's own reflection will lead him to make it satisfactorily. But whatever may be thought of the endeavour to exercise the discrimination of which geometry points out the possibility by framing or arguing on definitions, we do not remember to have seen one so well calculated for the mere beginner as the following:—'A straight line is a straight line.'

The postulates relative to a straight line demanded by Euclid (we do not speak of his translators) are: 1. That such a line can be drawn from any one point to any other. 2. That when terminated, it can be lengthened indefinitely. 3. That two such lines cannot inclose (μὴ περιέχειν) a space. It is also tacitly assumed that every part of a straight line is a straight line: that every straight line, infinitely produced, divides a plane in which it lies into two parts, and will be cut by any line drawn from a point on one side of it to a point on the other. It might also have been assumed that two straight lines which coincide in two points, coincide when produced beyond those points; but here Euclid has preferred to assume that all right angles are equal. [RIGHT ANGLE.]

The definition which Euclid gives of a plane, is that of a surface which lies evenly between its bounding straight lines. To this definition there is the serious objection that though a plane may be as easily conceived as a straight line, yet it is actually capable of definition by a straight line. For a plane is the surface any two points of which can be joined by a straight line which lies wholly on the surface. Neither this definition (nor Euclid's) precludes the necessity of a postulate demanding the possibility of drawing a plane through any straight line. Objections might be made to the first part of Euclid's eleventh book, which would require for their answer that another postulate should be granted, similar to that required for a straight line, namely, that if two planes coincide in any portion of surface, they coincide altogether. Euclid does in fact assume a postulate which is not expressly laid down, namely, that a finite straight line can be produced in every plane in which it lies, but we think it may be fairly doubted whether the first three propositions of the book in question are as perfect as they might be made.

STRAIN and STRESS. [MATERIALS, STRENGTH OF.]

STRAIN. [SPRAIN.]

STRALSUND, one of the three governments into which the Prussian province of Pomerania is divided, consists of what was formerly Swedish Pomerania, with the island of Rügen and some other islands: it is bounded on the north by the Baltic, on the east and south by the government of Stettin, and on the west by Mecklenburg-Schwerin. It is almost entirely surrounded by water, having the Baltic on the north, and being divided from Mecklenburg by the navigable rivers Trebel and Reckenitz, and by the Peene from the government of Stettin. This is the smallest of the three governments of Pomerania: the area is 1660 square miles, with a population of between 160,000 and 170,000 inhabitants; it is divided into four circles. The soil is a heavy loam and black mould, far superior in fertility to the light sandy soils of the governments of Stettin and Cöslin; the products are similar, consisting of wheat, barley, and peas; flax and tobacco are likewise cultivated. The breed of horned cattle is not numerous, for want of sufficient pasture; sheep and hogs however are in great numbers, and there are immense flocks of geese. There are no manufactures of any importance. Those of linens and woollens are insufficient, and produce only coarse articles. The manufactories of tobacco and the brandy distilleries are very considerable. The commerce of this government is very important and lucrative; the exports are chiefly flour, malt (5000 lasts annually), and, above all, corn, which constitutes a third, and sometimes the half of the exports, and for the most part goes to Sweden. The fisheries are likewise very profitable.

STRALSUND, the capital of the government, is situated in 54° 15′ N. lat. and 13° 8′ E. long., in an extensive low sandy plain, bounded on one side by the Strait of Gellen, which separates the island of Rügen from the continent;

and on the other sides by great lakes and marshes, so that it is connected with the continent only by bridges. The celebrated fortifications have been razed, and the ramparts converted into public walks. It is rather a gloomy place, the houses being built in the old style, the streets are irregular, and the squares and market-places inconsiderable: it is however clean and well paved. There are four Protestant churches and one Roman Catholic chapel. The three principal churches are built in the Gothic style, and contain many fine paintings. The prospect from the lofty steeple of St. Mary's is very extensive. Among the other public buildings worthy of notice are—the government-house, the town-house, with a noble hall, and a considerable public library, the gymnasium, with a large library and cabinet of medals, the mint, the arsenal, and the water-works by which the city is supplied with good water. The principal public institutions are—the gymnasium, the normal school for training schoolmasters, a school for soldiers' children, two schools of industry, besides many other schools: an orphan-house, a lunatic asylum, and various other charitable establishments. The manufactures are of various kinds, chiefly woollens, linen, sugar, starch, soap, candles, tobacco, leather, looking-glasses, household furniture, and playing-cards. There are likewise brandy distilleries and oil-mills. The trade of this city is very considerable, being at least one-third of the foreign commerce of the whole province. The harbour is spacious and safe, and deep enough for ships drawing 15 feet water. The northern outlet by the Gellen Strait has become gradually narrower, and Hassel says it is with difficulty kept open, but that the eastern channel has become broader. Stralsund was built about the year 1209, and joined the Hanseatic League, during its union with which powerful confederacy it had a very extensive export trade in wool and herrings to remote countries. At present the chief exports are malt, corn, and wool. The town has sustained several sieges; the most remarkable of which was in 1628, when Wallenstein vowed that 'he would make himself master of it, even though it were fastened by chains to Heaven,' but he was obliged to raise the siege after suffering considerable loss. In 1678 it was taken after a destructive bombardment by the great elector Frederic William of Brandenburg; and in 1715 by Frederick William I., king of Prussia, in alliance with Russia, Denmark, and Saxony against Sweden. The heroic Schill fell here in 1809. By the treaty of Kiel in 1810, it was ceded with all Swedish Pomerania to Denmark, and again ceded by Denmark in 1815 to Prussia.

(Müller, *Handbuch*; Heidemann, *Wörterbuch*; Hassel; Stein; Cannabich; Hörschelmann, &c.)

STRAMO'NIUM [DATURA.]

STRANGE, SIR ROBERT, a descendant of the family of Strange of Balcasky, in the county of Fife, was born at Pomona, one of the Orkney Isles, on the 14th of July, 1721. After successively adopting and abandoning the study of the law and the pursuit of a seafaring life, he was apprenticed to a drawing master. He had studied for a considerable time, when he joined the forces of the Pretender, and was appointed a lieutenant in the Life-Guards, a step he is said to have taken with a view of obtaining the hand of Miss Isabella Lumisden, a lady whom he married in 1747. After the battle of Culloden he sought refuge in the Highlands, where he suffered the severest privations. Subsequently he ventured to Edinburgh, where he subsisted upon the produce of a sale of his drawings of the chiefs of the rebellion, which he privately disposed of at a guinea each. After his marriage he went abroad, and at Rouen obtained an honorary prize for design, when he proceeded to Paris, where he studied engraving under the celebrated Le Bas, from whom he learned the use of the dry point, of which he made such successful use in his own plates. In 1751 Strange settled in London, and soon established a high reputation as an historical engraver, of which class he is considered to be the first in the English school.

In 1760 he again went abroad, and executed plates after pictures by many of the greatest of the old masters, and was made a member of the academies of Rome, Florence, Bologna, Parma, and Paris. On his return to England, he was received with every mark of distinction, and in 1787 was knighted. He died on the 5th of July, 1792. He left a widow, three sons and one daughter, amply provided for by the fruits of his industry and ability. Strange is the only Englishman whose portrait is introduced in the painting in the Vatican of 'The Progress of Engraving.' Force, vigour, clearness, and precision are the prevailing characteristics of his style, nor is he less noted for the careful distinction which he makes in his plates between the texture of the various materials represented. He was the author of an unpublished treatise entitled 'The History of the Progress of Engraving,' to which he added impressions of his principal plates and a portrait of himself. The following is a list of his most important works:—St Cecilia, after Raffaelle; the Virgin and Infant Christ, with Mary Magdalen, St. Jerome, and two Angels, after Correggio; Mary Magdalen, the Death of Cleopatra, Fortune flying over a Globe, Venus attended by the Graces, and Joseph and Potiphar's Wife, after Guido; Christ appearing to the Virgin after his Resurrection, Abraham expelling Hagar, Esther and Ahasuerus, and the Death of Dido, after Guercino; Venus and Adonis, Venus reclining, and Danäe, after Titian; Romulus and Remus, and Cæsar repudiating Pompeia, after Pietro da Cortona; Sappho consecrating her Lyre, after Carlo Dolci; the Martyrdom of St. Agnes, after Domenichino; Belisarius, after Salvator Rosa, the Virgin with St. Catherine and Angels contemplating the Infant Jesus, after Carlo Maratti; the Choice of Hercules, after Nicholas Poussin; and the Return from Market, after Philip Wouvermans. Amongst his portrait engravings may be particularly mentioned the Children of Charles I., and Queen Henrietta Maria, with the Prince of Wales, and Duke of York, after Vandyke. (*Memoir of Sir Robert Strange*; Aikin's *General Biography*.)

STRANRAER [WIGTONSHIRE.]

STRASBOURG (in German, *Strassburg*), a town in France, capital of the department of Bas Rhin, 243 miles east of Paris in a direct line, or 294 miles by the road through Château-Thierry, Châlons-sur-Marne, St. Dizier, Bar-le-Duc, Toul, Nancy, Lunéville, and Saverne; in 35′ N. lat. and 7° 47′ E. long.

Strasbourg was known to the Romans by the name of Argentoratum or Argentoratus. It is first mentioned by Ptolemy, who calls it a town of the Vangiones: but this is an error, as it really belonged to the Triboces. It was in the Roman province of Germania Prima or Superior (the First or Upper Germany); and it was near this town that Julian, while he held the command in Gaul, as Cæsar, defeated the Allemans under their king Chnodomar (A.D. 357). At a subsequent period it appears to have fallen into the hands of the Allemans, from whom it was taken by Clovis and the Franks. It was afterwards included in Lotharingia, or the kingdom of Lothaire; and in the tenth century was incorporated with the German empire. It was during these changes, perhaps in the sixth century, that it exchanged its antient name of Argentoratum for that of Stratae-burgus, modified into Stratzburg and Strassburg. It was in the landgraviate of Alsace; but having obtained the privileges of a free city, it increased in prosperity. In A.D. 1349 it suffered from a fearful mortality, which was attributed to the Jews, 200 of whom were in consequence burned. The principles of the Reformation were early introduced, and gained such ground, that, though checked by the emperor Charles V., the Protestants obtained possession of several of the churches. In 1681 Strasbourg surrendered to Louis XIV., who had previously gained possession of Alsace. Louis enlarged the circuit of the walls, and so improved the defences as to render it one of the strongest fortresses in Europe. It has remained ever since that period incorporated with France.

The town stands in a flat situation in the valley of the Rhine, which valley has here a considerable breadth, extending from the mountains of the Schwarzwald or Black Forest, to the Vosges. The form of the town is irregular. Its greatest length is from east to west, nearly two miles; its greatest breadth about one; and its circuit five or six. It is surrounded by a wall strengthened by bastions, ditches, and outworks, and has at its eastern extremity a citadel, with five bastions, constructed by Vauban, the outworks of which extend as far as the Rhine. This river flows a little to the east of Strasbourg, and is crossed here by the bridge of boats of Kehl, a fortress in Baden, on the right bank. The entrance into the city is by seven gates, two on the north side, one on the north-west, two on the west, and two on the south.

The river Ill flows through the town in a north-north-east direction. After it enters the town it is divided into several branches, which reunite before it quits the place. The principal arm, which bears the name of the Bruche, is

navigable, and receives on its right bank the canal of the Rhine, by means of which there is ready communication with that river. Another arm, which has the name of Tanners' ditch (fossé des Tanneurs), is much used for supplying tan yards and other manufacturing establishments. The river can be made to inundate the neighbourhood, by means of a sluice at the point where it enters the town. There are a great number of bridges, some of stone, others of wood. Some of the branches of the Ill, judging from their direction, have been the ditches dug to encircle and defend the town before it had attained its present extent.

Dr. Dibdin, who visited Strasbourg in July, 1818, thus describes its general appearance:—'The city of Strasbourg encloses within its walls a population of about fifty thousand. I suspect however that in former times its population was more numerous. At the present moment there are about two hundred and fifty streets, great and small, including squares and alleys. The main streets, upon the whole, are neither wide nor narrow; but to a stranger they have a very singular appearance, from the windows of almost every house being covered on the outside with iron bars arranged after divers fashions. This gives them a very prison-like effect, and is far from being ornamental, as it is sometimes intended to be. The glazing of the windows is also frequently very curious. In general the panes of glass are small and circular, being confined in leaden casements. The number of houses in Strasbourg is estimated at three thousand five hundred. There are not fewer than forty-seven bridges in the interior of the town. . . . . . The houses are generally lofty, and the roofs contain two or three tiers of open windows, garret fashioned, which gives them a picturesque appearance; but which, I learn, were constructed as granaries, to hold flour for the support of the inhabitants when the city should sustain a long and rigorous siege.' (*A Bibliographical, &c. Tour in France and Germany*, by the Rev. T. F. Dibdin, D.D.) From another authority we learn that the streets amount to more than two hundred and sixty, and are for the most part crooked and narrow; that there are several public squares, of which the principal is the parade, planted with trees, adjacent to the citadel: that the houses are for the most part built of stone, and that the antient houses in the German style are being gradually replaced by others of modern construction. (*Dictionnaire Géographique Universel*, Paris, 1832.)

The principal public building is the cathedral of Notre Dame, a Gothic edifice of singular beauty. The nave and choir have a total length of 355 English feet, of which 244 belong to the nave: the width of the nave, with its side aisles, is 132 feet, but the height of the nave is only 72 feet. Nine massive clustered columns, the larger of them having a circumference of 72 feet, the smaller of 30, support the roof on each side. The choir has no side aisles: it is 67 feet wide, and much lower than the nave. The sides have been covered most incongruously with a number of pillars and pilasters of Grecian architecture. There are two chapels, those of St Laurent and St. Catherine, besides that of Le Saint Sepulchre, which is the crypt; and twelve altars, of which the two principal are in the chapels of St. Laurent and St. Catherine. The windows are adorned with abundance of stained glass; but generally of a sombre tint, and producing a gloomy effect, with the exception of the circular or marygold window of the west front, which is brighter. There are a stone pulpit, unequalled for the richness, variety, and elaborateness of its sculptured ornaments; an organ of admirable power and softness; and a remarkable astronomical clock, formerly accounted one of the wonders of the place for the variety and skilfulness of its mechanical contrivances, and the elaborateness of its ornaments, but now much out of order, and useless. The most striking part of the cathedral is its western front, a masterpiece of enriched architecture, decidedly superior, in the opinion of some critics, to our own cathedrals of York, Lincoln, or Peterborough. It is divided into three compartments by its ornamented buttresses (two of which are at the angles, and two in the centre); and each compartment again into three portions by horizontal bands. The lower portions are occupied by three porches, that in the centre being the most ornamented and the loftiest. In the second or middle portion the most striking feature is the enormous circular or marygold window; and three equestrian statues of the Frankish kings Clovis and Dagobert, and the German emperor Rudolph of Hapsburgh, in canopied openings in the buttresses. A fourth canopied opening is unoccupied. The third or upper portion has some beautiful windows; and the northernmost of the three compartments is surmounted by a tower and spire, having at each of the four corners of the tower a spiral staircase enclosed in open work. The spire rises to the height of 500, or perhaps 530 English feet. The cathedral was commenced near the close of the thirteenth century; and the external structure, as it now appears, was completed about the beginning of the fifteenth. It was much injured during the Revolution: two hundred and thirty five statues were taken down from different parts of the building to be demolished, and only sixty five of them have been preserved.

This celebrated church was built at various periods: the choir is said to be of as early a date as the age of Pepin le Bref and Charlemagne; the nave was commenced in the early part of the eleventh century by the bishop, Werner of Hapsburg; and the west front and the tower were planned by Erwin or Ervin of Steinbach, an architect of the thirteenth and fourteenth centuries. He superintended the erection of these parts until his death, A.D. 1318. The tower was not finished till the middle of the fifteenth century. The architect who completed it was John Hültz, a native of Cologne.

Of the subordinate churches (Strasbourg possesses fifteen in all, seven Catholic, seven Lutheran, and one Calvinist, beside a Jews' synagogue), the most remarkable for size and antiquity is that of St Thomas, belonging to the Lutherans. Some portions are perhaps more antient than the cathedral, but the outside is a tasteless jumble of various styles, and the inside has been trimmed up and smartened in the most tasteless and incongruous style. It has several antient monuments: a much vaunted but really tasteless and absurd mausoleum of Le Maréchal de Saxe; and modest unassuming monuments of Schoepflin, Oberlin the classical scholar, and Koch the historian. The churches of St. Etienne and St. Martin are antient: Le Temple Neuf has some lancet-shaped stained glass windows of exquisite beauty. The public library is attached to this church, and some of the books are kept in the church itself.

The other principal buildings are the antient castle, with a terrace-walk on the Bruche; the office of the prefect; the town-hall; the custom-house; the court of justice; the public granary; and the theatre, adorned with an Ionic colonnade, and having a spacious and elegant interior. There are several public walks; among which are the promenade of Le Broglie, which skirts the Tanners' ditch, the ramparts, which are planted with trees, the esplanade in front of the citadel, the suburb of Robertsau or Rupersau on the north side of the town, and the islands of the Rhine, on one of which a monument has been erected to the memory of Desaix.

The population of Strasbourg, in 1831, was 45,642 for the town, or 49,712 for the whole commune; in 1836 it was 57,885 for the commune. The trade of the town is very considerable: its manufactures include jewellery, metal buttons, starch, alum, oil of vitriol, white-lead, steel, cutlery, pins, combs, cast-iron goods, earthenware, porcelain, enamel, soap, oil from seeds, succory or chiccory, morocco and other leather, straw and other hats, woollen and cotton stuffs, cotton yarn, hosiery, printed flannels, sail cloth, oilcloth, thread, carpeting, furs, paper-hangings, playing-cards, &c. There are bleach-grounds, dye-houses, rope-walks, tan-yards, breweries, printing-offices, plaster-kilns, tile-yards, an iron-forge, a type-foundry, a sugar refining-house, a royal snuff-manufactory, &c. The publication and sale of books is an important branch of industry at Strasbourg. There is a considerable trade carried on with other parts of France, and with Holland, Germany, Switzerland, and Italy, by means of the Rhine and the Ill and their connected navigation; and much business is done in the produce of the surrounding territory, which includes corn, wine, tobacco, madder, hemp, hops, saffron, &c. There are four important yearly fairs much frequented by the Germans.

Before the Revolution there was at Strasbourg a Protestant University, with four faculties. It was established by the town council or senate in 1538 as a gymnasium or public school: this was changed into an academy, with the power of granting degrees in arts, by the emperor Maximilian II., A.D. 1566; and was raised to the rank of a university by the emperor Ferdinand II., A.D. 1621. There are now two seminaries for the Roman Catholic priesthood; a Protestant seminary, and a gymnasium or college; a faculty of theology of the Lutheran body; and

faculties of law, medicine, science, and literature; a normal class for training schoolmasters; a school of midwifery and a school of medicine; a drawing-school; a royal college, with a philosophical apparatus; a museum, a cabinet of natural history, a cabinet of anatomy, an observatory, a botanic garden, where lectures are delivered, and a public library of above 50,000 volumes; an academic society, which confers premiums; a society of agriculture, sciences, and arts; a Protestant Bible society; a society for the relief of young persons discharged from prison who have shown symptoms of penitence; public baths; a noble arsenal, including a school of artillery and a cannon-foundry; vast barracks for cavalry, infantry, and artillery; a mont de piété or loan society; three hospitals, including one for orphans and one for foundlings; two military hospitals; a military prison, a gaol, and a house of correction, to which is attached a lunatic asylum; a number of government offices for fiscal, judicial, and administrative purposes; a mint, and a government stud (*dépôt des étalons*). It is the capital of the department; the seat of a bishop, who is a suffragan of the archbishop of Besançon, and whose diocese comprehends the departments of Bas Rhin and Haut Rhin; the seat of a Lutheran consistory, and of an académie universitaire, and the head-quarters of the fifth military division, which comprehends the two departments of Bas Rhin and Haut Rhin.

Strasbourg was the birthplace of Mentel, one of the fathers of the art of printing; of General Kleber, who was left by Bonaparte in command of the French army in Egypt; of the classical scholars Brunck, Oberlin, and Schweighaeuser; and of the philanthropist Oberlin, pastor of the Ban de la Roche, and brother of the scholar. The population of the town is partly Protestant and partly Roman Catholic. German may be considered as the native tongue of the inhabitants; but among the educated classes both German and French are used.

The arrondissement of Strasbourg has an area of 546 square miles, and comprehends 162 communes, with a population, in 1831, of 205,029, and, in 1836, of 218,839. It is divided into twelve cantons or districts, each under a justice of the peace. The bishopric dates from the fourth century: the bishop had formerly the title of prince of the empire, and was a suffragan of the archbishop of Mainz or Mayence.

STRATE'GY (from the Greek στρατηγία, which may be translated 'generalship') is, properly, the science of combining and employing the means which the different branches of the art of war afford for the purpose of forming projects of operations and of directing great military movements: it was formerly distinguished from the art of making dispositions, and of manœuvring, when in the presence of the enemy; but military writers now, in general, comprehend all these subjects under the denominations of grand and elementary tactics. [TACTICS.]

Strategy consists chiefly in making choice of convenient bases (fortified places or strong positions) in order to place there in security the military establishments of an army; such as the barracks, hospitals, and magazines of ammunition and provisions, previously to commencing offensive operations, or in contemplation of the army being compelled to act on the defensive. In the former case, it may be necessary to decide on undertaking the siege of some fortress on a frontier, for the purpose of holding the neighbouring district in subjection, and commanding the roads by which it may be thought convenient to penetrate into the enemy's country, or by which the provisions and warlike stores may be brought up to the immediate seat of the war. In the latter case, choice is to be made of positions strong by nature, or which may be made so by art, in order that the army may be enabled to dispute the ground gradually, to harass the enemy by frequent skirmishes, or to prevent him from receiving supplies by intercepting his convoys on the roads.

Thus, after the battle of Vittoria (1813) the allied British and Spanish armies being at a great distance from the original base of operations in Portugal, and it being intended to carry the war into France, Lord Wellington undertook to besiege St Sebastian and to blockade Pampeluna, in order, by the possession of those places, to have secure stations for his recruits and magazines while the army advanced into the mountainous districts between St. Jean Pied-de-Port and the sea. On the other hand, the conviction, in 1809, that the British army would be compelled to act entirely on the defensive, induced the English general to take measures for a retreat into Portugal, and to commence, many months before the retreat took place, two chains of strong redoubts on the north of Lisbon, in the expectation of being able there to resist effectually the very superior forces of the enemy.

The project formed by Marshal Soult, in 1813, in opposition to that of Lord Wellington, affords also a good illustration of the nature of strategical operations. The French general decided to advance towards Pampeluna in the hope of being able to succour that place, and afterwards to unite his army with that of Suchet in Aragon: he expected also to command the road along the Spanish frontier, by which he might have got to the rear of the allies in a fertile country, where his army could have found subsistence. (Napier, vol. vi.) This project failing, and the battles of the Pyrenees having forced the French army to act on the defensive, Marshal Soult took measures for protracting the war to the utmost.

In the defence of an extensive territory, since it is generally impossible to cover the whole, the principles of sound strategy indicate that the army should be kept in force on a few of the most important positions. By securing these, the designs of the enemy may be more effectually frustrated than if it were attempted to occupy every post in the country; for the different divisions of the army being in the latter case weak and ill supported, they are liable to be cut off in detail, whereas the difficulty of dislodging a large body of troops from one strongly intrenched position may deter the enemy from attempting it: at the same time the occupation of that position by the defending army may paralyze his movements by rendering it dangerous for him to leave in his rear a force which might prevent him from drawing supplies from his magazines. The evils attending the dissemination of troops over a great extent of country are strongly exemplified in the surprise of the Austrians by Marshal Turenne. The French general caused the several corps of his army to be drawn together towards Befort in such a manner as not to excite notice; and from thence suddenly penetrating into Alsace, in the midst of the enemy's quarters, he defeated the troops before they had time to unite.

STRATFORD-UPON-AVON, a municipal but not a parliamentary borough in the Stratford division of Barlichway hundred, in the county of Warwick, 96 miles northwest of the General Post-office, London, by Uxbridge, Beaconsfield, Wycombe, Oxford, Woodstock, and Shipston-on-Stour.

Stratford was a place of some consequence three centuries before the Conquest. The manor was included in the possessions of the bishopric of Worcester, the holders of which obtained charters from the earlier kings of the Plantagenet family for a market and five yearly fairs. In the reign of Edward VI. the manor came by exchange to Dudley, earl of Warwick and duke of Northumberland, and has since then passed through various hands. There was some skirmishing here in the great civil war (A.D. 1642-3). But the principal interest of the town is derived from its having been the birth-place of Shakspere (A.D. 1564), and the place to which he retired in his maturer years, and where he died (A.D. 1616). [SHAKSPERE, WILLIAM.] In A.D. 1769 a festival termed 'the Jubilee' was celebrated at Stratford, in honour of Shakspere, under the direction of Garrick. The festival was attended by a great concourse of persons of rank; but the incongruity of many of the arrangements provoked the satire of some of the wits of the day. A triennial festival in honour of Shakspere has been celebrated these last few years.

The town stands on the west or right bank of the Avon, and is approached from London by a long stone bridge of fourteen pointed arches, erected in the reign of Henry VII. at the sole charge of Sir Hugh Clopton, lord mayor of London, and widened of late years. There is another bridge just below, by which a railroad is carried across the river, and at the south end of the town is a wooden foot-bridge. The streets are irregularly laid out, but the principal ones are well-paved and remarkably clean. They are lighted in the winter with oil. The old houses are, many of them, commodious and well-built; some of the modern ones which are interspersed among them are capacious and handsome. The town has increased considerably during the last few years, and many houses have been built in the outskirts. The church is at the south-eastern corner of the

town, near the bank of the river. It is 'a large and handsome cross-church, the nave only separated for service. The transept, tower, and some parts of the nave are early English. The tower appears to have been strengthened by underbuilding the antient arches by others of perpendicular character. The upper part of it is decorated, with curious circular windows, having varied tracery. The south aisle is decorated, with some good windows; the west end of the nave, with the piers, arches, and clerestory, are perpendicular, as is the north porch. The chancel is late perpendicular, and a fine specimen of its date. On the north wall is Shakespeare's (Shakspere's) monument; on the south side are some stone stalls, and there are many of the wood stalls remaining. In the south aisle of the nave are the remains of some stone stalls which have had rich canopies. In some of the windows are portions of good stained glass. The present font is modern; the antient one, after being long a receptacle for rain water, is now carefully preserved in a gentleman's garden. It appears to have been perpendicular, of elegant design and good execution. The same gentleman also preserves part of the antient cross.' (Rickman, *Essay on Gothic Architecture*, Appendix.) The remains of Shakspere are buried in the chancel, on the north side, and are covered with a stone bearing this inscription:—

Good frend, for Jesus' sake forbeare
To digg the dust encloased heare;
Blese be ye man yt spares thes stones,
And curst be he yt moves my bones.

The monument against the wall is surmounted by a half-length effigy of Shakspere, executed with some taste and skill. It was originally coloured to represent life. Beneath the effigy is a poetical inscription consisting of a Latin distich and six lines of English verse; below the inscription is the record, 'OBIIT ANO. DOI. 1616, AETATIS 53, DIE 23 AP.' The church at Stratford was collegiate.

Besides the parish church there is a chapel-of-ease, anciently the chapel belonging to the brethren and sisters of the guild of the Holy Cross. At the dissolution of monastic institutions, the possessions of this fraternity passed to the crown, and were granted after some years to the corporation of Stratford for specific purposes. The chapel is of late perpendicular character, much like the chancel of the parish church. It was adorned within with fresco-paintings of singular character, which, after having been long covered with whitewash, were discovered during some repairs in 1804. They were too much injured however to allow of their being preserved. Adjoining the chapel is the hall of the guild, an antient building, which has undergone much alteration. The lower part is used for the business of the corporation, the upper part is occupied by the grammar-school. The residences of the schoolmaster and vicar, with the chapel and the hall of the guild, form three sides of a quadrangle. The town-hall, which is used for the larger meetings of the corporation and for other public purposes, is a modern building (A.D. 1768) of the Tuscan order. The principal room, 60 feet by 30, has some portraits; among them are one of Shakspere by Benjamin Wilson, and one of Garrick by Gainsborough. Outside of the building, on the west side, are the arms of the corporation; and on the north side, in a niche, is a statue of Shakspere. There are meeting-houses for Independents, Baptists, and Wesleyan Methodists. Part of the antient house, in which Shakspere is said to have been born, is standing in Henley Street on the north side of the town: a room is pointed out as the very chamber of his birth, and it may be really so: it is covered with the names of visitors. [SHAKSPERE.] 'New Place,' the residence of Shakspere in his latter years, was pulled down (A.D. 1759) by the Rev. Francis Gastrell, the owner, who had previously (A.D. 1756) cut down the famous mulberry-tree planted by the poet's own hand. The present theatre, a neat brick building, is appropriately placed within the precincts of Shakspere's garden.

The parish of Old Stratford, in which the town stands, has an area of 6860 acres; the population in 1831 was as follows: the borough of Stratford, 3488; the hamlet of Luddington, 127; outskirts of the borough and other parts of the parish, 1556: together, 5171. There were in the town 673 houses, inhabited by 683 families; 21 houses uninhabited, and 2 building. The only manufacture is that of Florentine silk buttons; the trade of the place, though not great, appears to be increasing. The navigation of the Avon commences here. The Stratford-upon-Avon canal runs from the north side of the town to the Worcester and Birmingham canal in the parish of King's Norton near Birmingham. It was made under several acts passed from A.D. 1793 to A.D. 1821. The Stratford and Moreton railway (constructed under Acts passed from A.D. 1821 to A.D. 1833) extends from near the termination of the canal to the town of Moreton-in-Marsh, Gloucestershire, 16 miles, with a branch (2¼ miles) to Shipston-on-Stour, in a detached portion of Worcestershire. The railroad consists of a single track, and horses are the moving-power: the railway crosses the Avon by a bridge. The coal brought by the canal from the South Staffordshire Coalfield [STAFFORDSHIRE] is sent forward to Moreton and Shipston by the railway; and stone and agricultural produce are brought back. The market at Stratford is now held on Friday, and is a considerable corn and cattle market. There are two yearly fairs, beside a statute-fair and several great cattle-markets.

Stratford is a municipal borough, but the borough limits do not include the whole town. The corporation was formed by a charter of Edward VI., A.D. 1553; and by the late Municipal Reform Act has 4 aldermen and 12 councillors. An enlargement of the boundary has been recommended. The borough is not to have a commission of the peace except on petition and grant. The borough courts had fallen into disuse previous to the passing of the act. The income of the corporation is considerable, consisting of the produce of the estate of the guild of the Holy Cross, and of the tithes formerly possessed by the college of priests belonging to the parish church. The corporation maintain an almshouse and the free grammar-school, and pay stipends to the vicar of Stratford and to a chaplain or vicar's assistant.

The living is a vicarage, of the clear yearly value of 239*l*., with a glebe-house: it is in the rural deanery of Kineton or Kington, in the archdeaconry and diocese of Worcester.

There were in the whole parish, in 1833, two infant-schools, with 240 children of both sexes; fourteen day-schools, with 664 children (viz. 432 boys and 204 girls, and 28 children of sex not stated); and three Sunday-schools, with 263 children; besides which, two of the day-schools, partly supported by voluntary contributions, with 130 boys and 60 girls, were also Sunday-schools. Two of the day-schools, with 130 boys and 70 girls, were national schools; another, with 12 boys, was the free grammar-school; and a fourth, with 28 children, was supported by voluntary contributions: the remainder, except the two which were also Sunday-schools, were private schools.

STRATFORD, FENNY. [BUCKINGHAMSHIRE.]

STRATFORD, STONY. [BUCKINGHAMSHIRE.]

STRATA. In Geology, both the separately deposited layers of rock, and the rocks formed of these similar layers, accumulated together, have received the name of strata. Dr. William Smith uses the term in the latter sense, and in general this is the meaning attached to it in those useful tabular expositions of the 'Series of Strata,' in various districts of the globe, which are now familiar to geologists. In special and local descriptions of rocks, the several beds are commonly enough called strata (*couches*, French). As a general scheme showing the rank frequently assigned to these and other terms, the following view may be useful, the most comprehensive term being to the left:—

Systems, Formations, Strata, Beds, Laminæ.

The terms series and group are very conveniently employed to collect under one head for purposes of reasoning, any of the laminæ, beds, strata, formations, or systems (or parts of one formation and parts of another), without any other limit than that imposed by the principle of grouping. For instance, the *Belemnitic Series* of strata includes the lias formation, lower, middle, and upper oolite formations, and the green-sand and chalk formations; it includes two systems of strata: by the *Trilobitic Series* of strata we may understand the whole of the Palaeozoic deposits, excepting perhaps the magnesian limestone and the oldest of the slaty rocks. [STRATIFICATION; GEOLOGY, &c.]

STRATICO, SIMONE, COUNT, born at Zara, in Dalmatia, in 1730, of a family originally from Candia, studied at Padua, where he took his doctor's degree, and was made professor of medicine in that University when only twenty-five years of age. In 1761 he accompanied to England the ambassador sent by the Venetian senate to congratulate George III. on his accession; and on his return to Padua he succeeded the Marquis Poleni in the

chair of mathematics and navigation. He wrote several works on hydraulics and hydrostatics, and upon naval architecture and navigation. In 1801 he was appointed by the government of the Italian republic to the chair of navigation in the University of Pavia, and under Napoleon's kingdom of Italy he was made inspector-general of roads, rivers, and canals, and senator of the kingdom and knight of the iron crown. After the Restoration the emperor of Austria gave him the cross of the order of St. Leopold. Count Stratico died at Milan, in 1824, at the age of ninety-four. His principal works are—1, 'Raccolta di Proposizioni d' Idrostatica ed Idraulica,' Padova, 1773; 2, 'Vocabolario di Marina,' 3 vols. 4to., Milan, 1813-14; a work which was wanted in the Italian language. Stratico collected the nautical expressions used by the Venetians, Pisans, and Genoese, in the time of their maritime greatness, and added the modern expressions adopted from the French and English; 3, 'Bibliografia di Marina,' 1823; 4, 'M. Vitruvii Pollionis Architectura cum Exercitationibus J. Poleni et Commentariis Variorum,' Udine, 1825. This is an excellent edition of Vitruvius, with important illustrations and comments by Poleni and Stratico, and was published after the latter's death. Stratico was one of the most distinguished men of science in Italy. His cabinet of models for shipbuilding, and his collection of books relative to the art of navigation, were bequeathed by him to the Lombardo-Venetian kingdom, and they have been placed in the library of the Institute of Milan.

(Maffei, *Letteratura Italiana:* Biographical Notice of Stratico, in the 'Antologia' of Florence, vol. xxi.)

STRATIFICATION. Mineral masses, separately deposited, and arranged into parallel layers under the influence of gravitation, compose a large portion of the known rocky crust of the earth, and are called stratified rocks. Other masses, in which no such successive deposition and tendency to be bounded by originally horizontal surfaces is traceable, are locally prevalent, and receive the name of unstratified rocks: they are generally supposed to be of igneous origin; the former are mostly known to be the fruit of sedimentary aggregation under water. To each class there are exceptions. Parts of certain limestone rocks, formed in water, as modern coral reefs, are really not at all or very slightly stratified: and certain melted rocks which have spread in successive sheets like lava over antient surfaces, or have been forced by great lateral pressure between really stratified rocks, often assume the stratiform aspect. Without now dwelling on these and several other exceptional cases, it is our purpose to present a general view of the present state of knowledge of the phenomena of stratification, as exhibited in rocks which show clearly the fact of their mineral particles having been separately subject, during the aggregation of the mass, to the influence of gravitation, while partially supported in media lighter than themselves, as water and air, and generally influenced by lateral movements, such as occur in a state of nature in those almost universal fluids.

1. Let us suppose a case of a shower of comminuted mineral matter falling through a limited section of air on the ground. It will be collected in a conical form, the slopes of the cone having reference to the velocity of descent of the sandy particles, the mutual support they yield one to another, and the form of the surface on which they fall. Omitting these sources of variation, the slopes of the conical heap will be generally within moderate limits of uniformity, and the inclination of these slopes constitutes what is called the *angle of rest*. A second shower of such sandy matters falling uniformly, will cover the cone with a parallel sheath, and thus *conical strata* may result from such operations repeated. (See diagram No. 1.) The nearest analogy to this

No. 1.

Vertical section of strata formed by conical superposition (theoretical).

type of stratification occurs in a volcanic cone; where however the showers of ashes falling not uniformly, but in different quantities in different directions, the result is a *streamy* or imperfectly concentric stratification, characteristic of the cause, and presenting on a cross-section an appearance as in the diagram No. 2.

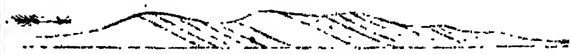
2. If further we suppose a shower of ashes or sands to

No. 2.

Horizontal section of strata formed by falling of ashes round a vertical axis irregularly.

be much affected while falling by horizontal currents of air; in this case the supposed conical heaps No. 1 will be drifted, so as to show stratification inclined or dipping from the windy quarter. (See diagram No. 3.) Similar effects might follow the drifting of sand which had fallen into heaps.

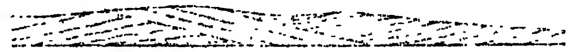
No. 3.



Laminated deposits of sand by the effect of wind.

If the currents of air changed their direction at intervals, there would arise complication of the strata, *oblique stratifications*, such as are often seen in sandy rocks and sandhills, and these would be more or less distinct as the interval between the winds had been marked by vegetation, sediment, or any other cause of consolidation of the surfaces. (See No. 4.)

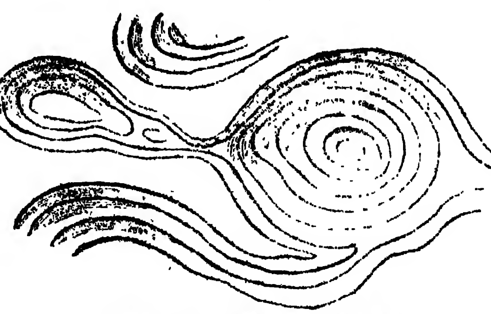
No. 4.



Oblique lamination in sand and gravel.

3. On surfaces of loose sand once deposited, under whatever of the influences stated, winds have the power of producing other effects; winds eddying among the inequalities of partially grass-grown sandhills, excavate in them circular, oval, or irregular pits, and make ridges and crests of fantastic forms. (Diag. No. 5.) Winds also wear away by

No. 5.



Excavation of cavities in sandhills by wind.

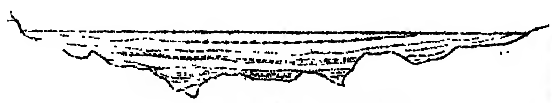
horizontal action the edges of these basins and crests, and make appearances of level stratification, as water which changes level wears its banks in parallel lines. Winds also by their peculiar action on fluid or loose masses, which move with a different velocity from the current of air, produce undulations on the surface of the sand lying across the current, and much resembling the 'ripple or current mark' (which is a secondary phenomenon from the same cause) on the beds of sand below agitated water.

The falling velocity in air of the different sorts of mineral particles which enter into the composition of rocks is not materially different, even if the masses be considerably unequal in size; but both in regard to falling in water and drifting by wind or water, the specific gravity and the magnitude of the masses require to be taken into account.

For our present purpose it is sufficient to observe that in a mixture of pebbles and sand, subject to drifting, there is an angle of ascent which limits the movement of the pebbles, and yet allows the sands to pass on. Hence, on the sea-coast, the almost stationary pebbly beach is margined on the landward side by parallel ridges of moving sandhills, and thus a separation is effected of the bases of conglomerates and the bases of sandstones.

If now, instead of comminuted materials falling through air on the land or drifted by wind over its surface, we imagine such materials falling on and sinking in lakes perfectly calm, or the sea always in motion, other effects will follow, and other forms of stratification will result. In a calm lake the sediment may be supposed to fall vertically downwards, and, except the bed of the lake be very irregular, to settle in layers or strata of considerable uniformity. The least lateral moment, by mixing the suspended matter through the water, would tend to widen the deposit, and to fill up the inequalities of the lake-bed, so that by many repetitions a very irregular subaqueous surface would be equalized and levelled. This effect is perhaps actually witnessed in the sediment called trass which lies in the valley of Brohl, near Andernach; this is apparently derived from volcanic dust stratified in the water which received the shower of ashes. (No. 6.) Besides showers of

No. 6.



Arrangement of ashes falling in a lake.

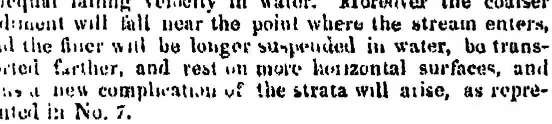
ashes, lakes and the sea receive comminuted mineral substances from shores wasted by tides and storms, and from rivers which transport detritus from the interior of the country. In a very calm lake the sediment from the influx of rivers subsides under the influence of gravitation downwards and communicated motion forwards, so that a kind of conical stratification in a delta continually advancing with a level top into the lake is the result. In this delta the arrangement of the strata is probably such as to exhibit successive layers dipping forward into the lake, but there may also be some more horizontal lines depending on the separation of the coarser and finer sediment, owing to their unequal falling velocity in water. Moreover the coarser sediment will fall near the point where the stream enters, and the finer will be longer suspended in water, be transported farther, and rest on more horizontal surfaces, and thus a new complication of the strata will arise, as represented in No. 7.

No. 7.

Deposition of coarse gravel and sand (g) and fine clay (c) in a lake by a river (r)

The earthy materials poured into the sea by rivers follow the same general laws of distribution, but are subject to the additional effects of tides and storms. The effects of these agencies are exhibited in great distinctness on coasts which confront violent winds and the full oceanic flow, and which are margined by pebbles and sands. The sands with ripple-marked surfaces gently inclined extend to some distance below low-water, the pebbles spread upwards in more steeply inclined banks thrown up and left by the breakers in heaps, long parallel ridges, and terraces. A contemporaneous surface of deposition in such cases may be as represented in No. 8, where clay or sand below low-water, and

No. 8.



Gravel beaches (g), sand beds (s), and fine clay (c), in the sea, under the influence of the tides.

pebbles between low and high water, appear in a continuous layer. Such a surface differs from that found under a calm lake by the concave slope of its pebbly laminæ toward the shore, while the lake deposit has convex slopes in the same part.

Such appearances, at least partially, may perhaps be recognised among the strata accompanying coal, and in other groups of rocks where the unequal size of the granular materials and antient exposure of these to littoral agitation supply the necessary conditions.

Near the shore various causes locally in operation are known to produce on the sea-bed that oblique and variously directed lamination which has been already noticed as an effect of wind (diagram No. 4), and may be seen as an ordinary occurrence in the sections of 'diluvium' and in the banks of rapid rivers which change irregularly their channel. (See the notice of this effect in the valley of the Arve, in Lyell's *Principles of Geology*.) Among the stratified rocks this appearance is common. It occurs in Sussex among wealden strata supposed to be of fluviatile origin; at Nottingham in new red-sandstone, which contains no internal evidence of the nature of the water in which it was arranged; in millstone grit of Yorkshire, and in the oolite of Weston near Malton, and Old Down near Bath, which are all deposits from the sea. It is perhaps impracticable to determine by mere inspection of the oblique lamination alluded to the exact order of phenomena which occasioned it. Tidal agitation, fluviatile violence, the force of temporary inundations, sea currents, each and all of these may have been concerned in the phenomena of this nature, which are so frequent in pebbly sandstones, and in general we may be justified in believing that such appearances may be safely ascribed in most cases to irregular violence of shallow water; while in regard to the more regular and extended parallel lamination of ordinary micaceous sandstones, and still more the fine uniform deposits of clay and argillaceous limestone, must be referred to the wider and gentler influence and longer suspension due to calmer, that is to say, generally deeper water, farther from shore.

The origin of the materials of stratified rocks is seldom obscure. Conglomerates full of pebbles rounded by attrition, sandstones with grains worn and rounded, shales and clays with broken and scattered mica, and disseminated fragments of other minerals, are so similar to ordinary accumulations by the diurnal agency of water, that no person can hesitate about the origin of such materials. Many of these are *recomposite rocks*; as the old red-sandstone conglomerates, which contain pieces of quartz from mineral veins, and masses of previously consolidated grauwacke. Others, as new red-sandstone, seem to be derived from wasting shores or the detritus of inundations; and certain schistose beds in the older strata of Devon, Cornwall, and Shropshire are positively aggregations of ashes, scattered by volcanic explosions on the antient ocean. It has been conjectured that the same explanation may apply to some other portions of the great series of Palæozoic slaty rocks, and in a few cases a direct reaggregration of the materials of trap rocks (Oban) or granite rocks (millstone grit of Derbyshire) appear. Well stratified limestones have probably been formed from precipitation of carbonate of lime, as now happens in lakes and in the sea; and the limited portions of the same rocks which show no such structure, are often certainly known to be, like modern reefs, the fruit of coralligenous polypiaria.

The changes to which the sedimentary deposits, which were the origin of stratified rocks, have been subject since their aggregation, are so considerable, as to gain for them, in extreme cases, the distinctive title of *Metamorphic Rocks*.

Consolidation of mass is the first of these changes to which we may here allude. It appears to be a phenomenon principally due to *pressure*: as in the buried peat of Dartmoor, and the buried clays of Holderness, the originally light and uncondensed matters have been compressed to some considerable firmness, solidity, and weight; so in respect of antient clays, mere pressure appears to be a sufficient cause for their condensed, often shaly consistence. But more than this must be appealed to for the *induration* of slate, coal, limestone, and sandstone. The *particles* of these rocks cohere with force, by a process of internal molecular arrangement; and it appears to be a fair inference from numerous facts, that among the most influential of the exciting causes of this molecular action is the internal heat of the globe—locally manifested in the induration of stratified masses in the vicinity of trap dykes and other igneous rock masses, and generally exhibited in the hardness, symmetrical structure, and crystalloid aspect of the lower and more antient strata, which may be supposed to have been more subject, and for a longer time than the others, to the influence of subterranean heat.

Very unequivocal signs of this action of heat appear in the vicinity of the granite rocks of Cumberland, Devon,

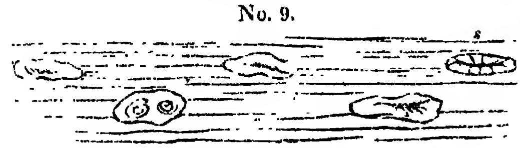
Cornwall, Wicklow, &c., and perhaps they are seldom absent from such situations. One of the most ordinary of such effects is the development, in the mass of the stratified rocks, of peculiar crystals, as felspar near the granite of Wastdale Head, in virtue of which slates become porphyry; of hornblende and chiastolite in those of Skiddaw, just as garnets are developed in argillaceous beds near the trap rocks of Teesdale and Anglesey. [Rocks.]

There is some danger of carrying too far the application of this doctrine. The metamorphism of rocks is a real and very extensive phenomenon, but we must have always a reason for referring to this class any peculiar appearances of stratified rocks which differ from the ordinary appearances of common aqueous sediments. We must not ascribe to re-arrangement of molecules what is not consistent with such an effect, nor without examination call textures of rocks imperfect crystallization and re-arrangement of molecules which perhaps may be only due to disintegration and re-aggregation of masses.

A case of this kind is very important; the primary strata of gneiss and mica-schist are often, without examination, but merely by applying as a universal consequence what really depends on very partial inquiry, declared to be crystallized, or crystalline, or crystalloid rocks; when, in fact, in many cases they are really, as MacCulloch knew, stratified aggregations of the disintegrated parts of crystallized rocks, and in others show evidence of the same origin, disguised by subsequently applied heat. [Geology—*Primary Periods*.]

Some cases of re-arrangement of particles depend on molecular action, not excited by heat, but determined to particular centres by the previous existence there of solidified bodies. Oolite is an example of common occurrence among limestones of the secondary class, and few things are more interesting to examine than a polished slab of the oolite of the mountain limestone of Bristol and Lancashire, or the pisolite of Wilts. In the centre of the spherical grains of the former, and in or near the axis of the less regular nodules of the latter, are grains of sand, bits of shells, or small foraminifera, and round these parallel coats of carbonate of lime are neatly and concentrically arranged. An extremely large and irregular pisolitic nodule gives us the link between these concretionary arrangements and the 'nodules' or 'balls' of limestone and ironstone which enclose pieces of plants, leaflets of ferns, shells, bones, or fish-scales, and lie in parallel layers in the coal-shales, lias clays, &c. These balls are evidently formed by accretion round the organic objects which they enclose, and the process is the more curious, because the matter of the ball is usually more calcareous or more ferruginous than the surrounding matrix, and seems to have been collected from out of it by some peculiar elective attraction depending on the nature of the organic body. (See Diagram No. 9.)

No. 9.



Re-arrangement of deposited matter in nodules, round organic or inorganic masses; *s*, one of these cracked as in Septaria.

In addition to this process it has frequently happened that the 'ball' has been cracked internally across by subsequent contraction during *consolidation*, and the cracks are filled by carbonate of lime, iron pyrites, silica, &c., introduced through the apparently solid texture of the external parts according to the peculiar circumstances of the operation. Thus by a peculiar species of electrical transfer, analogous to what is supposed in the case of mineral veins, the internal cavities become filled, and the result is the septarium, for whose formation internal heat was once deemed necessary by the advocates of the Huttonian hypothesis. (Playfair's *Illustrations*, p. 30.) Derived from sources so various, and aggregated under aqueous agencies so diversified in respect of power and direction, it is not surprising that the stratified rocks present themselves in a variety of appearances. It is clear that in the same bed of the antient sea, or on the same basin of the actual sea, contemporaneous surfaces of deposition might extend over calcareous, argillaceous, arenaceous, and pebbly deposits: that in different basins contemporaneous deposits might be extremely unlike; and that metamorphism, more or less important, must be allowed to have often further increased such original diversity. Yet, notwithstanding these limitations, it appears to be a fact sufficiently established that there are general characters of mineral composition and structural aggregation which are associated with the strata of each great period of the earth's history, so as more or less completely to distinguish one period from another. [Geology.]

STRATON, the son of Arcesilaus, and a native of Lampsacus, a Peripatetic, who about B.C. 286 undertook the charge of the Peripatetic school after Theophrastus. He was the master of Ptolemy Philadelphus, and was well paid for his services.

Respecting his doctrine only scattered hints can be gathered, as all his works have perished. He differed from his master Aristotle on certain points. He maintained that there was a principle of motion destitute of intelligence inherent in all matter; which principle causes all composition and decomposition of bodies; that the world, in consequence, was not formed by an extramundane deity, nor by any intramundane animating pervading intelligence: but it was formed by the innate force of matter, which momently creates and dissolves. He was called Physicus (φυσικός), from his making physical matters his chief study. A list of his works is given by Diogenes Laertius (*Straton*), and a copy of the philosopher's testament.

Eight persons of the name of Straton are enumerated by Diogenes.

(Diog. Laert., 'Straton;' Cicero, *De Natura Deorum*, i. 13; Brucker, *Instit. Hist. Phil.*)

STRATTON. [Cornwall.]

STRAUBING is a considerable town in the province of Lower Bavaria (previously called the circle of the Lower Danube), in the kingdom of Bavaria, in 48° 53′ N. lat. and 11° 35′ E. long., in a pleasant country, on an eminence on the right bank of the Danube. The town is divided into the Upper and Lower town, and is surrounded with walls, in which there are four principal gates; but the walls are now for the most part broken, and the moat converted into gardens. It is tolerably well built. The population is about 7000. The Danube here divides into two arms, one of which flows close by the town, half a league below which they again unite. There is a stone bridge 325 feet in length over the Danube, from which the unfortunate Agnes Bernanernon, wife of duke Albert, was thrown on the 12th of October, 1435, by order of her father, a citizen of Augsburg, without whose knowledge the Duke had married her. She was celebrated for her extraordinary beauty. Her husband erected a handsome monument to her in St. Peter's church, which still remains. The principal public buildings are the seven churches, the palace, the government-house, the gymnasium, and the town-house. There are four hospitals, a seminary for schoolmasters, a convent of Ursuline nuns, in which there is an establishment for female education, and numerous charitable institutions. The handsomest part of the town is the great square, in which are the church of the Holy Trinity, the palace, the town-house, the government-house, and the church of St. James and St. Veit. This town has, properly speaking, no manufactures, but it has a good trade on the Danube, and great corn and cattle markets. The surrounding country is remarkably fertile. The town has frequently suffered by extensive fires.

(*Conversations Lexicon*; Stein; Cannabich; Hörschelmann; Von Schlieben, *Gemälde der Deutschen Bundesstaaten*.)

STRAW-PLAT MANUFACTURE AND TRADE. The domestic character of this branch of industry, which renders it peculiarly important as a means of affording employment to women and children, especially in agricultural districts, may probably account for the circumstance that very little is known of its history. An interesting account of this manufacture is given in M'Culloch's 'Dictionary of Commerce,' in the article 'Hats,' and some information on the subject may be gleaned from the published 'Transactions' of the Society for the Encouragement of Arts, Manufactures, and Commerce. From these and some minor sources of information, the following details are derived.

The article first alluded to (which is stated to be written by Mr. Robert Slater, of Fore Street, London) observes, that it is not known when the manufacture of hats or bonnets of platted straw first became important in Italy, where it has long formed one of the leading pursuits of the

agricultural population, but that it appears from Coryat's 'Crudities,' published in 1611, that 'delicate strawen hats' were worn at that time by both men and women in many places in Piedmont. Coryat states that many of these hats had at least a hundred seams, from which it is evident that very fine plat was made at that time. The same article states that the straw-plat manufacture does not appear to have been followed in England for more than sixty or seventy years, 'as it is within the remembrance of some of the old inhabitants of the straw districts, now alive, that the wives and daughters of the farmers used to plait straw for making their own bonnets, before straw-plaiting became established as a manufacture.' This was published in 1834. Gipsy straw-hats were worn by ladies in this country about 1745-6, according to the 'Pictorial History of England' (vol. iv., p. 806). When Arthur Young visited Dunstable, in 1768, the straw-plat manufacture appears to have been established, though not very extensively. He says (*Six Months' Tour*, vol. i., p. 16), 'At that place is a manufacture of basket-work, which they have carried to a great perfection of neatness, and make of hats, boxes, baskets, &c. a large quantity annually; but not a great number of hands are employed by it.' In the 'Commercial Gazetteer' appended to Macpherson's 'Annals of Commerce,' published in 1805, Dunstable is described as 'a town in the neighbourhood of which the women and children are employed in making hats, baskets, and many fancy articles, of straw, which in their hands assumes a vast variety of figures and colours, and produces considerable emolument, especially since the straw hats have been in general request among the ladies.'

The large size of the wheat-straw used in this country for platting prevented the home manufacture from entering into competition with that of Italy in articles of fine quality; the straw grown for the purpose in Tuscany being much smaller, as well as superior in colour. This difficulty was in some degree overcome by the expedient adopted in England towards the end of the last century, of splitting the straw, and using the narrow *splints*, or slips of straw, in lieu of whole straws. The operation of splitting is performed by small cutting instruments called *machines*, which have a number of sharp edges so fixed as to divide the straw, by a motion in the direction of its length, into four, five, six, or more equal parts. Before machines were invented, straws were occasionally split with knives by hand; a process which was both tedious and unsatisfactory, since it gave no security for the uniform width of the splints, upon which the beauty of the plat greatly depends. It has been stated that the ingenuity of the person who contrived the machine used for this purpose was rewarded by realising a fortune of 30,000*l.*; but a communication from a correspondent at Watford gives a very different account of the matter. Our informant states that his father, Thomas Simmons (now deceased), was residing when a boy, about the year 1785, at Chalfont St. Peter's, Buckinghamshire, and that when amusing himself one evening by cutting pieces of wood, he made an article upon which he put a straw, and found that it divided it into several pieces. A female who was present asked him to give it to her, observing that if he could not make money of it, she could. She had the instrument, and gave the boy a shilling. He was subsequently apprenticed to a blacksmith; and, on visiting his friends, he found them engaged in splitting straws with a penknife. Perceiving that the operation might be much better performed by an apparatus similar to that which he had made some time before, he then made some machines of iron on the same principle. So far from realising a fortune by the invention, his son states that he only realised one shilling. The inconvenience of the process as performed by hand may possibly have led more than one individual to devise similar means for overcoming the difficulty. Be this as it may, the introduction of split straw gave a great impulse to the plat manufacture. Mr. Corston, in a letter addressed to the Society of Arts in 1810, observes that 'by the mere invention of the splitting of a straw a source of employment has been discovered, which has increased the returns in that branch not less than from 300,000*l.* to 400,000*l.* annually.'

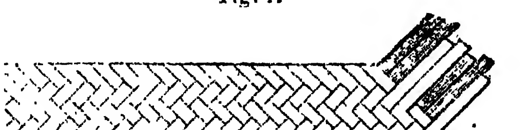
Greatly as the British straw-plat manufacture had been encouraged by the use of split straw, by improvements in bleaching, and by increased care in the selection of straws of uniform size and colour, it was found, when the re-establishment of peace allowed the free importation of Italian straw hats, that the home manufacture was unable to compete with the foreign, notwithstanding the heavy protecting duty levied upon hats or bonnets of straw imported from other countries. The Society of Arts has therefore, for a long series of years, offered encouragement to attempts for the improvement of the British straw manufacture, which has called forth many interesting communications, and has led to great improvement. As early as 1805, the Society presented a gold medal to Mr. William Corston, of Ludgate-hill, for a substitute, of his invention, for Leghorn plat. His plat was formed of rye-straw, and was so good that some specimens had been examined by London tradesmen, who confessed their inability to discover the difference between them and the real Italian Leghorn. Mr. Corston states that 781,605 straw hats had been imported from 1794 to 1803; and that in the last four years of that period 5281 lbs. of straw-plat, which was equal to 26,405 hats, had also been brought to this country. By the introduction of his new plat, it was considered that much poor land might be brought into profitable cultivation, and that employment might be provided for many females and children. In a subsequent communication, dated May, 1810, Mr. Corston states that the country was beginning to reap the benefit of his proposals. (*Trans. of the Soc. of Arts*, vols. xxiii. and xxviii.) More recently rye-straw has been tried for the same purpose by Messrs. J. and A. Muir, of Greenock, who attempted to establish the straw-plat manufacture in the Orkneys. These gentlemen communicated the results of their experiments to the forty-fourth and forty-fifth volumes of the 'Transactions' of the Society of Arts. The manufacture is still followed in the Orkneys.

In the fortieth volume of the Society's 'Transactions,' which was published in 1823, the defects of British straw plat were particularly noticed. In plat made of split straw, unless two splints are laid together, with their inside surfaces towards each other, as in the plat called 'patent Dunstable,' it necessarily happens that the face of the plat exhibits alternately the outer and inner surfaces of the straw, which differ from each other in colour and gloss. Articles made of split straw are also inferior to those of whole straw of equal fineness, in pliability and durability. Another circumstance which greatly increases the beauty of Leghorn plat is the mode of joining it, so as to form, by the combination of several narrow strips, an extended sheet of platted work. British plat is usually joined by making the several rows of plat overwrap each other a little, and then stitching through the two overwrapping pieces with a needle and thread. The surface of a hat or bonnet formed in this manner consists of a series of ridges; and part of each row of plat is concealed by that next above it, so that an unnecessarily large quantity of plat is required to form a given extent of surface. Thus to form a band one inch wide, with a plat a quarter of an inch wide, it will be necessary to use *five* pieces of plat; at least a fourth part of the width of each being absorbed by the overwrapping joint. Leghorn plat is formed in such a manner that it may be joined without this loss; the edge of one row of plat being, as it were, knitted into the edge of the other, in such a way that the pattern may appear uninterrupted, and the line of junction may be almost invisible. In addition to these differences of quality, it is stated that the cheapness of labour on the Continent gave a great advantage to foreign competitors; so much so, indeed, that the best Hertfordshire straw might be, and actually was, sent to Switzerland, platted there, and thence returned to England, paying the import duty of 17*s.* per lb., and yet sold 25 per cent. cheaper than that platted in this country. The Society were therefore very desirous of promoting such improvements in British straw-plat as might place the manufacture in a more favourable position. With this view they awarded, in 1822, a silver medal and twenty guineas to Miss Sophia Woodhouse (afterwards Mrs. Wells), of Connecticut, in the United States, for a new material for straw plat. This material is a kind of grass (poa pratensis) which grows spontaneously in that part of the United States, and is there called 'ticklemoth.' The plat she formed of it is stated to be superior to Leghorn in fineness and colour. Miss Woodhouse sent seeds to the Society, from which the grass was raised in this country; and she also communicated an account of the process of manufacture. (*Trans. of the Soc. of Arts*, vol. xl.) In the following year, Mr. Cobbett communicated to the Society his experiments on native British grasses, of which several appeared likely

to answer for platting; and some rewards have been since bestowed for experiments of like character. Before noticing these, allusion must be made to another, and a very important paper, in the fortieth volume of their 'Transactions.'

The paper alluded to is a communication from Mr. John Parry, who received, in 1822, the large silver medal of the Society for the manufacture of Leghorn plat from straw imported from Italy. The import duty charged upon straw-plat was then, as it still is, considerably less than that upon straw hats or bonnets, and the duty on unmanufactured straw still less in proportion. The home manufacture of Italian straw had been tried, but without success, by Mr. Bigg; and it was afterwards attempted by Mr. Parry, who, at the date of his communication, had more than seventy women and children employed in it. The ears are, it is stated, cut off with a knife, and the straws are then carefully sorted to obtain uniformity in length, thickness, and colour. The plat of which the formation is described, and of which an engraving is given to illustrate the description, consists of thirteen straws. These are to be tied together at one end, and then divided into two portions; six straws being turned towards the left side, and seven to the right, so that the two portions of straw may form a right angle. The seventh or outermost straw on the right-hand side is then to be turned down by the finger and thumb of the right hand, and brought under two straws, over two, and under two. This being done, there will be seven straws on the left and six on the right side of the angle; and the next operation is to turn down the outermost of the seven with the left-hand finger and thumb, and to pass it under two straws, over two, and under two. The right side will again have seven, and the left side six straws; and the platting must be continued in the same manner, alternately doubling and platting the outermost seventh straw from side to side, until it becomes too short to cross over so as to double on the other side of the angle. The platter is then to take another straw, and to put it under the short end at the point of the angle (the middle of the plat), and, by another straw coming under and over the joined one from both sides of the angle in the operation of platting, it will become fastened; the short end being then left out underneath the plat, and the newly fastened straw taking its place on that side of the angle to which the short one was directed. The plat thus formed is represented in the cut *Fig.* 1, copied from the engraving which accompanies Mr. Parry's communication. It is about double the real size. The plat is formed in pieces

Fig. 1.



of great length, which are adjusted in spiral coils, with their adjacent edges knitted together, so as to form the large circular pieces of plat which, under the name of hats, or *flats*, are so extensively exported from the north of Italy. The mode of effecting the junction is described in the same volume, and may be explained by the help of the annexed cuts. *Fig.* 2 represents, about four times the real size, the two adjacent edges when knitted together; the dotted lines indicating the edges of each piece of plat, and showing how far the angular folds, or *eyes*, of one piece are inserted into those of the adjoining piece. The thread by which the two rows of plat are held together is here straight, and is entirely concealed in the plat. The joint is, indeed, only to be detected on either side by the slightly increased thickness of the plat where the angles are inserted into each other, and the thickness of the thread itself. The mode of junction may perhaps be better understood from *Fig.* 3, which represents the pieces of plat drawn a little asunder, and shows the course of the thread, which is indicated by dotted lines where it is covered by the straw. The operation is performed by pushing a needle through the folds in the required order, and, after passing it through as many as can be conveniently done at once, drawing it through in the manner of a bodkin, leaving its place to be taken by the

Fig. 2.

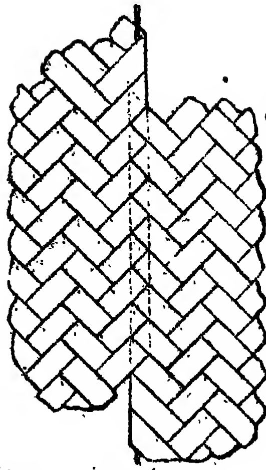
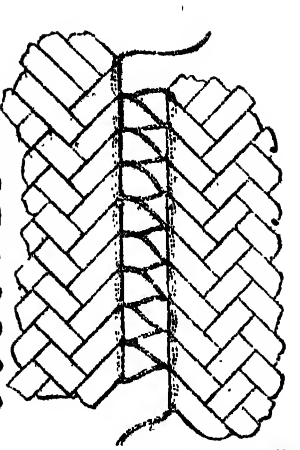


Fig. 3.



thread. It is observed that if the edges of the plat are not thrust sufficiently close, the needle will miss some of the folds, and the junction, though not visibly imperfect, is really so. It is further stated that sometimes, for the sake of expedition, only every other fold is threaded. This is a very injudicious practice, because it requires a coarser thread to make the junction secure, and therefore, by rendering the line of junction more prominent, impairs the beauty of the work. In arranging the plat in a spiral coil, as in making a hat, it is necessary, in a few places, to force two loops of the smaller circle into one of the larger circle adjoining it, to allow for their different diameters.

The information thus circulated respecting the mode of manufacturing Italian plat, has been of great importance to the British manufacture. In the year after it was published the Society of Arts rewarded sixteen individuals for the production of bonnets formed of grasses indigenous to Britain, platted and joined according to the Italian methods. Several of the specimens produced were even finer than real Leghorn; but it should be remembered that such extreme fineness can only be attained by a sacrifice of strength, and also that it increases the work. Most of them were imperfect in colour and regularity of size; but these defects are not incapable of remedy. The Society reported, that 'Upon the whole it appears to be satisfactorily proved that the stems of the crested dog's-tail grass are a material for plat finer than the average quality of Leghorn; and that the deficiencies in texture and colour of most of the bonnets produced before the Society are only such as practice and experience will shortly remove.' (*Transactions*, vol. xlii., p. 79.)

Various statements have been made respecting the material commonly used for plat in Tuscany. According to a communication made by Mr. W. Salisbury to the Society of Arts (*Transactions*, vol. xliii., p. 21), the straw used is that of *triticum turgidum*, a variety of bearded wheat, which seems to differ in no respect from the spring wheat grown in the vale of Evesham and in other parts of England. It is grown in Tuscany solely for the straw, and not for the grain; and the upper joint of the straw is that chiefly used for platting. Dr. Ure states (*Dict. of Arts, &c.*, p. 1190) that the straw is pulled while the ear is in a soft milky state; the corn having been sown very close, and consequently produced in a thin, short, and dwindled condition. It is then dried by spreading it thinly upon the ground in fine hot weather, and afterwards tied up in bundles and stacked, for the purpose of enabling the heat of the mow to drive off any remaining moisture. 'It is important,' he further says, 'to keep the ends of the straw air-tight, in order to retain the pith, and prevent the gummy particles from passing off by evaporation.' After remaining in the mow for about a month, it is spread out in a meadow, and exposed to the action of dew, sun, and air, in order to bleach it. The straw is frequently turned during this operation; and after it is completed, the lower joint of the straw is pulled off, leaving the upper joint, with the ear attached to it, for use. This part is then subjected to the action of steam, and to fumigation with sulphur, in order to complete the bleaching, after which it is ready for use. It is tied up in bundles, and imported to England in this state.

Bleaching with sulphur is commonly practised in this country, and Dr. Ure states that a solution of chloride of lime may be used for the purpose. The apparatus he describes for the former process consists of a cask open at both ends, with its seams papered. It is to be set upright on the ground, having a hoop nailed to it inside, about six inches beneath the top, to support another hoop with a net stretched across it, upon which the straw is to be laid loosely. The cask is then covered with a tight overlapping lid, stuffed with lists of cloth. A brazier of burning charcoal is inserted beneath the cask, and upon this is placed an iron dish containing pieces of brimstone. The brimstone soon takes fire, and the sulphurous acid gas evolved during its combustion fills the cask, and bleaches the straw in three or four hours. Care must be taken to prevent the too rapid combustion of the sulphur, which might cause black burned spots on the straw. After bleaching, the straw is to be aired and softened by spreading it upon grass for a night, and it is then ready for splitting.

Straw may be dyed, for ornamental purposes, of many different colours. Dr. Ure states that blue is given by a boiling-hot solution of indigo in sulphuric acid; yellow, by decoction of turmeric; red, by boiling hanks of coarse scarlet wool in a bath of weak alum-water containing the straw; or directly, by cochineal, salt of tin, and tartar. Brazil wood and orchil are also employed for dyeing straw.

The *splints*, or pieces of split straw, being curved in a way which would impede the operation of platting, require to be flattened between rollers. These, as well as the whole straws used in other kinds of plat, are moistened with water to render them easy to work. It need hardly be observed that cleanliness is indispensable to the beauty of the plat. Hence the Italian platters find the spring to be the most favourable season for the work, as the plat is not then exposed to the smoky atmosphere of the huts as in winter, nor to the dust and perspiration of summer. The Italian plat is dressed and polished by passing it forcibly between the hand and a sharp piece of wood. It is needless to enumerate the varieties of straw-plat, of which there are many, differing in the number and mode of platting the straws, in the circumstance of the straws being whole or split, &c.

In the kind of straw-platting above described, the plat is formed into a narrow strip or riband, which must be formed into a spiral coil, or united edge to edge, to form a hat or bonnet. In 1834, Mr. T. B. Smith, of St. Alban's, received a prize from the Society of Arts for applying Brazilian plat to the manufacture of hats and bonnets of split straw. This kind of plat is not formed in strips, but is at once platted or woven into the required form and size. The process is fully explained, and illustrated with cuts, in the fiftieth volume of the Society's 'Transactions.' One advantage claimed for the method is that either the glossy or the dull surface of the split straw may be placed entirely on one side of the plat.

The British straw-plat district comprises Bedfordshire, Hertfordshire, and Buckinghamshire; those counties being, according to M'Culloch's 'Dictionary,' the most favourable for the production of the wheat-straw commonly used for English plat. The manufacture is also followed, according to the same authority, in a few places in Essex and Suffolk; but very little in other counties. The principal markets are Luton, Dunstable, and St. Alban's. In Italy the manufacture is chiefly followed in the neighbourhood of Florence, Pisa, Siena, and the Val d'Arno, in the duchy of Tuscany; and it is also established in Venice and other places. There, as in England, the manufacture is purely domestic. The chief market is Florence; and the demand is principally from England, France, Germany, and America. Of late years the demand has fallen off so greatly, that many of the Italians have abandoned the manufacture.

The following tables, compiled from official returns, will show how greatly the imports of straw hats have diminished of late years, especially from Italy; and will also indicate, by the increased imports of straw-plat and straw for platting, the gratifying progress of that department of the British manufacture in which foreign materials are used with home labour.

I. Table showing the number of *straw hats* imported, exported, and entered for home consumption, and the net revenue derived therefrom, in each period of five years, from 1820 to 1839:—

Years.	Imported. Number.	Exported. Number.	Home Consumption. Number	Net Revenue £.
1820-4	676,479	42,905	626,236	180,5[illegible]
1825-9	1,356,767	70,455	1,217,221	343,[illegible]
1830-4	458,437	174,432	356,258	101,[illegible]
1835-9	83,600	73,824	20,299	6,6[illegible]
	2,575,283	361,616	2,220,014	£631,4[illegible]

During the period embraced by this table the import duty was as follows:—*3l. 8s.* per dozen upon hats not exceeding twenty-two inches in diameter, down to August 16, 1837, and not exceeding twenty-four inches in diameter after that date; and *6l 16s.* per dozen for hats of larger dimensions. We are not acquainted with any published data for showing, for the whole of this period, the proportionate amount of imports from different countries; but from 1827 to 1829 about 83¾ per cent. of the total number of straw hats imported were from Italy, about 15¼ per cent. from France, and rather less than 1 per cent. from Holland and Belgium. In the five years from 1830 to 1834, the principal imports were—from Italy, 89½ per cent. of the whole; from France, about 8½ per cent.; and from the United States, about 1¼ per cent. From 1835 to 1839 the proportions were about as follow:—Italy, 38½ per cent.; France, 26⅗ per cent.; Philippine Islands, 14⅗ per cent; United States, 17⅞ per cent.; East India Company's territories, 6⅗ per cent.; British North America, 3 per cent.; and Russia, 1⅗ per cent. The remaining fraction in each case consists of very small quantities imported from various places.

II. Table showing the quantities of *straw-platting* imported, exported, and entered for home consumption, and the net revenue derived therefrom, in each period of five years, from 1820 to 1839:—

Years.	Imported. lbs.	Exported. lbs.	Home Consumption. lbs.	Net Revenue £
1820-4	9,051	..	8,497	7,224
1825-9	38,585	2,629	31,153	26,176
1830-4	116,241	10,096	89,794	74,813
1835-9	185,789	52,685	141,956	119,085
	349,666	65,410	271,400	£227,398

The import duty on straw-platting, during the whole of the above period, was at the rate of *17s.* per lb.

III. Table showing the quantities of *straw and grass for platting* imported, exported, and entered for home consumption, the rate of duty, and the net revenue derived therefrom, from 1820 to 1839:—

Years.	Imported. £	Exported. £	Home Consumption. £	Rate of Duty.	Net Revenue £
1820-4	..*	..	..	20 per cent. ad valorem.	..
1825-9	12,100	..	12,100	10 per cent. ad valorem.	3,081
1830-2	41,359	22	41,344	Do.	4,092
	Cwts.	Cwts.	Cwts.		
1833-4	4,479	40	4,784	*1d.* per cwt.	9
1835-9	17,172	252	16,928	Do.	72

STRAWBERRY, the English name of the fruit and plant of the *Fragaria*, a genus of plants belonging to the natural order Rosaceæ. The fruit of the Fragaria is one of the most delicious of our summer fruits. The name Fragaria is derived from the Latin *Fragum:* and the English name from the practice in this country of cultivating the plant with straw surrounding it.

The genus Fragaria is known in its family by possessing a calyx with a concave tube, the limb of which is 10-parted, and the outer 5 segments accessory; 5 petals; stamens and carpels indefinite, the latter placed upon a fleshy and succulent receptacle, forming the juicy and succulent part of the fruit.

The species are perennial plants, throwing out runners: the leaves are trifoliate, each leaflet being coarsely toothed: the receptacle on which is seated the carpels, and which is called the fruit, is round, and assumes a variety of colours from a scarcely perceptible pink to a dark red

* This is for 1834 only; the tables issued by the Board of Trade (part iii., 1820-33) state that in 1833 the repayments exceeded the gross receipts

Several species of this genus have been described. Linnæus gave only two; but Wildenow admitted eight; and Geo. Don, in 'Miller's Dictionary,' enumerates fourteen. Duchesne, who is followed by many French botanists, makes only two species, and makes the species of other writers varieties of these. All of them are natives of temperate or cold climates; and are found in Europe, America, and the mountains of Asia.

As with regard to plants so extensively cultivated as the strawberry, it is frequently difficult to distinguish between the varieties and species, we shall follow Don, and enumerate those species which afford the varieties of cultivated strawberries.

Wood or alpine strawberry (*Fragaria vesca*) has plicate leaves, pilose beneath; the sepals reflexed, and the hairs on the peduncle pressed down. It is found wild in woods and on hill-sides throughout Europe, and is abundant in Great Britain. Duchesne describes eight varieties of this species, mostly characterised by the different form of the fruit or fleshy receptacle. Many of these produce the cultivated varieties which are known in gardens. The *F. v. semperflorens* produces the red, the white, the American, and Danish alpine strawberries, all of which are of a fine flavour, and greatly valued. *F. v. minor* produces the red wood-strawberry, or *frasier d'Angleterre*, and the white wood strawberry, both very fine kinds. To the *F. v. eflagellis* belongs the red and white alpine bush-strawberry, but these do not produce so good fruit as the last.

Hill strawberry (*Fragaria collina*) has the sepals erect after flowering, and the hairs on the peduncles and calyx erect. This species is a native of Switzerland and Germany, and is characterised by its producing green fruit. The varieties of strawberries which are called green are the produce of this species. In flavour and size they are only a second rate strawberry.

The Majaufe of the French (*Fragaria Majaufea*) has long stamens, with the calyx pressed down after flowering. This species is a native of France, and produces a fruit which is known in that country under the name of *Majaufe*.

Hautbois strawberry (*Fragaria elatior*) has the sepals reflexed on the peduncle, the hairs of the peduncles and petioles extending horizontally. It is a native of North America, and is occasionally found in groves in the south of England. The shape, size, and colour of the fruit of the hautbois are subject to great varieties, according to its mode of cultivation. It is the parent of a great number of sorts known in gardens, most of which, when properly managed, produce fruits of a first-rate kind. The most common of these are the black, brown, and common hautbois; the globe, the large flat hautbois, the long-fruited muscatella, and Sir Joseph Banks, belong to this species.

Virginian strawberry (*Fragaria virginiana*) has the calyx expanded after flowering; the hairs of the peduncle pressed down, and those of the petiole upright. It is a native of Virginia, and to this species belong the great list of sorts cultivated in gardens and known by the name of scarlet and black strawberries. The various kinds of scarlet, globe, cone, and some pine strawberries are produced from this species.

Large-flowered strawberry (*Fragaria grandiflora*) has leaflets glaucous, coriaceous, crenated, glabrous above, and pilose beneath; reflexed sepals, and hairs on the peduncles and petioles spreading. It is a native of Surinam, and has furnished our gardens with the sorts called pine strawberries. The various sorts named Bath, pine, Carolina, Dutch, and others, belong to this species.

Chili strawberry (*Fragaria Chilensis*) has leaves obovate obtuse, with silky villi beneath; calyx erect, hairs on peduncles and petioles spreading. It is a native of South America, both in Chili and Peru, and is the parent of a number of mostly inferior strawberries.

The other species of Fragaria do not bear strawberries that are worthy of cultivation.

Strawberries, when ripe, may be eaten in almost any quantity without injury. They are frequently eaten mixed with sugar and cream or wine. When ripe and well grown they hardly require such additions; but when their sugar is deficient, this ingredient may be safely added; and the addition of wine under these circumstances should be preferred to cream, as the latter is very liable to disagree with disordered stomachs.

Strawberries may be propagated either by means of their suckers or runners, or by sowing seed. The young plants will generally bear the year after they have been planted or sown. In order to obtain the fruit in perfection, they should be planted where they have access to abundance of light and air. Plants grown from runners are best for new beds, and should be planted out in March, in beds with three or four rows, leaving an alley between each bed. The alleys should be wide, the beds kept clear from weeds, and the runners cut at least three times in the season. In the autumn the rows should be dug between, and in the spring some straw or dung should be laid between the rows. If the latter produces too luxuriant a growth of the plants, it should not be employed. The *pine strawberries* require a light loam. The rows of the beds should be two feet apart, the plants eighteen inches asunder, and the alleys three feet wide between each bed. The *scarlet strawberries* may be treated in the same manner. The duration of these and the preceding strawberries is about three years. The *hautbois* require a light soil and the same general treatment; and as they are diœcious, care should be taken that there are male plants in the bed in the proportion of about one to ten. The *wood-strawberry* is best produced from seed, which should be sown as soon as it is obtained from the fruit, and should be planted in beds in March, in the same way as the others. The *alpine strawberry* is best grown from seeds, which should not be sown till the spring, and may be planted in July or August, in rows at the back of hedges or walls, in a rich or moist soil. The duration of these and the last seldom exceeds two years.

As a choice selection of sorts that can be procured for the garden, Mr. Lindley recommends the following:—Austrian Scarlet, Black Roseberry, Grove-end Scarlet, Old Scarlet, Roseberry, Downton, Sweet Cone—all varieties of *Fragaria virginiana*; Black Prince, Elton's Seedling, Keen's Seedling, Old Pine—varieties of *F. grandiflora*. Large Flat Hautbois, Prolific Hautbois—varieties of *F. elatior*; Red Alpine, White Alpine—varieties of *F. vesca*; Wilmot's Superb, Old Scarlet—varieties of *F. Chilensis*.

For further information see Lindley's *Guide to the Orchard and Kitchen-Garden*; Don's 'Miller,' vol. ii.; *Hort. Transactions*, vol. ii

STREATHAM. [SURREY.]

STREETS, PAVEMENT OF. [ROAD.]

STRELITZ, the capital of the grand-duchy of Mecklenburg-Strelitz, is situated in 53° 25′ N. lat. and 13° E. long. It consists of two parts, Old Strelitz and New Strelitz, which are not quite contiguous, but about a mile distant from each other, and though considered as one town, each has its own magistrates. Old Strelitz, which was formerly the residence of the duke, has 3500 inhabitants, among whom there are 450 Jews, who have a synagogue, a rabbi, and their own judges. The inhabitants manufacture leather, tobacco and tobacco-pipes, and are partly employed in agriculture and gardening. They have four annual fairs, one of which is a much-frequented horse-fair. There are some public offices, an hospital, a workhouse and lunatic asylum, a church, and a free-school with five masters. The ducal palace, at Old Strelitz, having been destroyed by fire in 1713, the duke built a new one at a place called Ghenke, a short distance from it, and in 1733 founded New Strelitz, a very neat town, built in the form of a star, with eight rays diverging from the market-place in the centre. This town, which is now the residence of the duke and the seat of the principal government offices, has a gymnasium and several schools. The most remarkable edifice is the ducal palace, in which there is a library of 50,000 volumes, a cabinet of medals, and a very curious collection of German antiquities. The palace has a fine garden and an extensive park. The inhabitants, now near 6000, have no manufactures of any importance, and derive their subsistence chiefly from the expenditure of the court and the public offices, from handicrafts and agriculture. The environs of the town, which is situated on the Zirker lake, are very pleasant.

(Hassel; Stein; Hörschelmann; Hempel, *Beschreibung von Mecklenburg*.)

STRELITZES. [PETER THE GREAT: RUSSIA.]

STRENGTH OF BEAMS AND OTHER MATERIALS. [MATERIALS, STRENGTH OF; ROOF.]

STREPSICERUS, Colonel Smith's name for the Koodoo. [ANTELOPE, vol. ii., p. 78.]

STRE'PSILAS. [SCOLOPACIDÆ, vol. xxi., p. 86.]

STREPTAXIS, Mr. J. E. Gray's name for a genus of pulmoniferous mollusks, separated from *Helix* on account of the eccentricity of the penultimate whorl.

Generic Character.—*Shell* ovate or oblong; subhemispherical in the young state, deeply umbilicated, and with the whorls rapidly enlarging. As the shell becomes complete, the penultimate whorl is bent towards the right and dorsal side of the axis, where the umbilicus becomes compressed, and often nearly closed. Aperture lunulate, border of the outer lip thickened and reflected; a single tooth often present on the outer side of the inner lip.

Example, *Streptaxis contusa*. [HELICIDÆ, vol. xii., p. 110.]

STREPTOSPO'NDYLUS, H. von Meyer's name for an extinct genus of reptiles belonging to the *Cœlospondylian tribe* of the *Crocodilian order* in the arrangement of Professor Owen, who thus defines the vertebral characters of this highly interesting form, the *Steneosaurus rostro-major* of Geoffroy, and the *Crocodile d'Honfleur* of Cuvier:—

'The distinguishing vertebral characters are a ball-and-socket articulation of the bodies of the vertebræ; but the positions of the ball and cavity are the reverse of those in the existing crocodiles, the convexity being on the anterior part of the vertebra, and the concavity directed backwards. In the anterior vertebræ, which have the ribs articulated with the body, there is a deep pit behind the costal articular surface; the transverse process rises by four salient ridges, one from each oblique process, and the two inferior and principal ones from the base of the neurapophysis; these ridges converge at an acute angle as they ascend, and meet at the under part of the transverse process, so as to include a triangular space, which is deeply concave. A third salient ridge ascends from the fore part of the base of the neurapophysis to the anterior oblique process, nearly parallel with the posterior of the two last-mentioned ridges, so that the side of each neurapophysis appears as if marked with the letter N in high relief. In the cervical and anterior dorsal vertebræ there are, instead of a single inferior spinous process, two ridges, which terminate each in front by a tubercle.'—(*Report on British Fossil Reptiles. British Association.*)

The Professor states that he is not aware that remains of this Crocodilian genus have hitherto been recognised in any of the British strata, and he proceeds to describe certain fossils found in the oolite in the vicinity of Chipping Norton, among which the anterior half of an anterior dorsal vertebra belonging to this animal, and in the collection of Mr. Kingdon of that town, is described as follows:—

'The articular surfaces for the ribs are, as usual, close to the anterior part of the body of the vertebra, and this terminates by a convex articular surface, instead of being, as in the Crocodiles, concave: the second character is the remarkably deep pit behind each of the costal articular surfaces. It is as if a man had pressed his two thumbs forwards and inwards up to the first joint, into the substance of the body of the vertebra, until their extremities had nearly met. The aperture of each pit measures one inch by ten lines. Sufficient of the neurapophysial arch is preserved to show the depression which has separated the two anterior ridges of its external surface; but these characteristic ridges, with the transverse spinous and oblique processes, are wanting. The medullary canal is compressed, and gives an oval vertical section one inch six lines high, and one inch two lines wide. Both upper and lower surfaces of the medullary canal are flat, and join the lateral surfaces at nearly a right angle. There is a slight ridge along each side of the medullary canal, indicating the neurapophysial suture, which extends here outwards and obliquely downwards to above the middle of the costal depression. This depression is vertically ovate, with a deeper oblique pit in the middle, two inches in the long diameter, by one inch six lines across the broadest part. The texture of this vertebra is coarsely cellular, except for about two lines at the margin, where it is in very compact laminæ. The anterior articular surface of the centrum is slightly and irregularly convex, being nearly flat at the upper part.

'There is a slight deviation from the symmetrical figure in the whole of this vertebral fragment. The body of the vertebra is much compressed in the middle, and suddenly expands to form the terminal articular surface. This character is likewise indicated by Cuvier in his *Crocodile d'Honfleur*;* thus the transverse diameters of the middle of the vertebral body, across which the present fossil has been fractured, measures two inches three lines, whilst the same diameter of the convex articular extremity is four inches.

'The corresponding diameters of one of the anterior dorsal vertebræ of the *Streptospondylus*, described by Cuvier, are respectively one inch seven lines, and two inches six lines; whence we may conjecture that the length of the entire vertebra here described would have been four inches and a half. The vertical diameter of the articular surface is three inches nine lines.

'The non-articular surface of the vertebral body is smooth, except near the articular extremity, where it is rather coarsely rugous. The inferior ridges and tubercles have disappeared at the part of the vertebral column to which the present vertebra has belonged.

'The osseous substance of the present fossil, like that of the bones of the *Streptospondylus* from Honfleur, present a deep chocolate-brown hue, and take a bright polish. It is not completely mineralized; the small cavities of a great part of the diploë are empty, and not filled with semitransparent calcareous spath, as in the Honfleur specimens.' (*Loc. cit.*)

We now proceed to the other fossils from the same locality recorded by the Professor:—

'With the portion of the vertebra above described there was associated the extremity of a spinous process, which gradually expands to a rough obtuse quadrilateral summit. This spine is characterised by having a very rugged and thick ridge, developed from the anterior and posterior surface of what may be regarded as the ordinary spinous process, the sides of which are smooth, except near the summit.

	Inches.	Lines.
'The length of this fragment of spine is	3	-
The transverse diameter of the base .	0	9
The transverse diameter of the summit of the apex	1	6
Antero-posterior diameter of spine :	1	3
Ditto, including the ridges . .	1	10

'The anterior and posterior ridges are narrower than the surface from which they rise.

'In the Crocodile a thin plate is continued from the anterior and posterior edges of the thicker spinous processes: but the *Streptospondylus* presents an extreme and peculiar development of this structure.

'A portion of a compressed, conical, hollow tooth, with a brown dense glistening dentine, resembling that of the *Megalosaurus*, was associated with the preceding vertebra. The length of this fragment is 2 inches 1 line, but both ends are wanting. The breadth is 8 lines; the thickness 5 lines.

'If it really belong to the *Streptospondylus*, it confirms the view of the affinity of that genus to *Megalosaurus*, which has been suggested by the characters of the vertebra. This tooth was found associated with the preceding fragment in the oolite at Chipping Norton. With these were likewise found a portion of a broad flat bone, with a convex, rough, articular labrum, nearly two inches thick, and of a fine cancellous structure, and fragments of long bones, with large medullary cavities and compact outer walls, of which the thickness equals about one-third of the diameter of the medullary canal.'

Professor Owen then notices a posterior dorsal vertebra from the jet-rock (lias shale) near Whitby (much more complete than the preceding specimen, and nearly corresponding in size with the dorsal vertebræ of the Honfleur *Streptospondylus* described by Cuvier), in the collection of Mr. Ripley of Whitby; and informs us that the third British formation in which he has determined the remains of the genus is the Wealden, specimens having been obtained from three localities, viz. Tilgate Forest, in Sussex, and Brook Point and Culver Cliff, in the Isle of Wight. The specimens, he observes, differ in size from those already described, being larger than the *Streptospondylus Cuvieri* from the oolite, and he strongly suspects that they indicate a different species, indeed he names it *Streptospondylus major*, but remarks that the means of comparison for the satisfactory establishment of the distinction are as yet wanting. Professor Owen also makes mention of a cervical vertebra associated, as in the Mantellian Collection, with vertebræ of the *Iguanodon* and *Cetiosaurus*, which and

* 'Le corps de cette vertèbre, ainsi que des suivantes est beaucoup plus rétreci dans son milieu que dans les Crocodiles ordinaires.'—*Ossem. Foss.*, [illegible] tom. v., pt. 2, p. 150.

been washed out of the submarine Wealden beds at the south side of the Isle of Wight, and thrown on shore near Culver Cliffs and Brook Point: this specimen is in the museum of Mr. Saull, of Aldersgate street, London. Some idea of the size of this reptile may be derived from Professor Owen's admeasurements, which give 5 inches as the transverse diameter of the posterior concave articular surface in the Wealden, and 6 inches in the Culver Cliff specimen, whilst the transverse diameter of the body across the inferior transverse processes is 8 inches in the Tilgate, and 6 inches 6 lines in the Culver Cliff specimen, the height of the latter from the lower surface of the centrum to the hind part of the base of the spine being 7 inches 9 lines.

The Professor further observes that the vertebra from the forest marble alluded to in the note at p. 297 of Dr. Mantell's 'Geology of the South-east of England' is a centrum from the posterior part of the dorsal region of the *Streptospondylus major*.

The foreign localities in which remains of *Streptospondylus* have been found are the Oxford clay formation at Honfleur, and the Kimmeridge-clay at Havre (Cuv.); and the lias of Altdorf (H. von Meyer).

We have called the form of this extinct Saurian highly interesting, for it presents those transitional characters which, while they beautifully manifest the passage, so to speak, from one specific form to another, are too apt to lead a superficial observer to wild speculations. Professor Owen, in his luminous argument at the close of the valuable Report above quoted, against the transmutation theory—fallacy, we would venture to call it—of Maillet, Lamarck, and their followers, observes that if the three forms of extinct Saurians, *Ichthyosaurus*, *Plesiosaurus*, and *Teleosaurus*, whose changes of specific and generic characters have thus been speculated upon, had actually succeeded each other in strata successively superimposed in the order here set forth, some colour of probability might attach itself to this hypothesis, and there would be ground for searching more closely into the anatomical and physiological possibilities of such transmutations. Those genera however, he observes, appeared contemporaneously on the stage of vital existence: one neither preceded nor came after the other. How the transmutation theory is to be reconciled to these facts is not, he justly observes, obvious, nor to these other, viz. that the Teleosaur ceases with the oolite, while the Ichthyosaur and Plesiosaur continue to co-exist to the deposition of the chalk, and disappear together alike unchanged; the Ichthyosaur manifesting as little tendency to develop itself into a Plesiosaur as this to degrade itself into the more fish-like form of the Enaliosaurian type.

'If,' continues the Professor, 'it were urged that the *Streptospondylus*, or crocodile with ball-and-socket vertebræ, of which the remains occur in later secondary strata, when the Teleosaur had ceased to exist, might be a modification of the apparently extinct amphicœlian crocodile, in which the vertebræ had undergone a progressive development analogous to that by which the biconcave joints of the vertebræ of the tadpole are actually converted into the ball-and-socket joints of those of the mature frog, the facts of both geology and anatomy again oppose themselves to such an hypothesis; for the remains of the *Streptospondylus* occur likewise in the Whitby lias, which is the earliest formation characterized by remains of the *Teleosaurus*; and the modification of the vertebral structure by which the *Streptospondylus* differs from its antient contemporary, and which it retains unaltered throughout the whole series of oolitic strata, is no approximation to the ball and-socket structure of modern crocodiles, which first appears in the *Mosasaurus* and the Eocene crocodiles, but is the very reverse. As reasonably might we infer that the Teleosaur was an intermediate form between the *Streptospondylus* and modern crocodiles, and that the anterior ball had first subsided, and a sub-biconcave type of vertebræ had been produced before the posterior ball which characterizes the vertebræ of recent crocodiles was finally developed. If the present species of animals had resulted from progressive development and transmutation of former species, each class ought now to present its typical characters under their highest recognised conditions of organization; but the review of the characters of fossil reptiles taken in the present Report proves that this is not the case. No reptile now exists which combines a complicated and thecodont dentition with limbs so proportionally large and strong, having such well-developed marrow-bones, and sustaining the weight of the trunk by synchondrosis or anchylosis to so long and complicated a sacrum, as in the order *Dinosauria*. The Megalosaurs and Iguanodons, rejoicing in these undeniably most perfect modifications of the Reptilian type, attained the greatest bulk, and must have played the most conspicuous parts in their respective characters as devourers of animals and feeders upon vegetables that this earth has ever witnessed in oviparous and cold-blooded creatures. They were as superior in organization and in bulk to the crocodiles that preceded them, as to those which came after them.'

There is not the slightest ground for affirming that the procœlian gavial of the present day is in any respect more highly organised than the opisthocœlian gavial of the oldest lias. If the differences of vertebral structure in these Crocodilians were contrasted in reference to their relative approximation to the vertebral structure of the higher animals, the resemblance of the ball and socket joints of the spine of the *Streptospondylus* to those of certain mammals would give precedence in organic perfection to the primæval gavial. If therefore the extinct species, in which the Reptilian organization culminated, were on the march of development to a higher type, the *Megalosaurus* ought to have given origin to the carnivorous mammalia, and the herbivorous should have been derived from the *Iguanodon*. But where is the trace of such mammalia in the strata immediately succeeding those in which we lose sight of the relics of the great Dinosaurian Reptiles; or where indeed can any mammiferous animal be pointed out whose organization can by any ingenuity or licence of conjecture be derived, without violation of all known anatomical and physiological principles, from transmutation or progressive development of the highest reptiles? If something more than a slight inspection be bestowed upon the organic relics deposited in the crust of the globe, we learn that the introduction of mammalia on that crust is independent of the appearance of the highest forms of reptiles. The small insectivorous mammals of the lower oolite* are contemporary with the most antient Dinosaur, and are anterior to the *Iguanodon*. The period when the class of reptiles flourished under the widest modifications, in the greatest number, and of the highest grade of organization, is passed: and since the extinction of the Dinosaurian order it has been declining. The *Reptilia* are now in great part superseded by higher classes. Pterodactyles have given way to birds; Megalosaurs and Iguanodons to carnivorous and herbivorous mammalia; but the sudden extinction of the one and the abrupt appearance of the other, are alike inexplicable on any known natural causes or analogies.'

Our limits will not allow us to quote more of this well digested argument, to which we refer those who are interested in this inquiry; but we must not omit the following propositions laid down by Professor Owen in the course of the discussion:—

'The fossil reptiles, like the fossil fishes, approximate nearest to existing species in the tertiary deposits, and differ from them most widely in strata whose antiquity is highest.

'Not a single species of fossil reptile now lives on the present surface of the globe.

'The characters of modern genera cannot be applied to any species of fossil reptile in strata lower than the tertiary formations.

'No reptile with vertebræ articulated like those of existing species has been discovered below the chalk.

'Some doubt may be entertained as to whether the *Ichthyosaurus communis* did not leave its remains in both oolitic and cretaceous formations; but with this exception no single species of fossil reptile has yet been found that is common to any two great geological formations.

'The evidence acquired by the researches which are detailed in the body of this Report permits of no other conclusion than that the different species of reptiles were suddenly introduced upon the earth's surface, although it demonstrates a certain systematic regularity in the order of their appearance. Upon the whole they make a progressive approach to the organization of the existing species, yet not by an uninterrupted succession of approximating steps. Neither is the organization one of ascent, for the reptiles have not begun by the type of organization by which at the present day they most closely approach fishes; nor have

* *Thylacotherium* and *Phascolotherium*. [Marsupialia, vol. xiv, p. 454, et seq.]

they terminated at the opposite extreme, where we know that the reptilian type of structure made the nearest approach to birds and mammals.

'Thus, though a general progression may be discerned, the interruptions and faults, to use a geological phrase, negative the notion that the progression has been the result of self-developing energies adequate to a transmutation of specific characters; but on the contrary support the conclusion that the modifications of osteological structure which characterise the extinct reptiles were originally impressed upon them at their creation, and have been neither derived from improvement of a lower, nor lost by progressive development into a higher type.'

STRETTON. [SHROPSHIRE.]

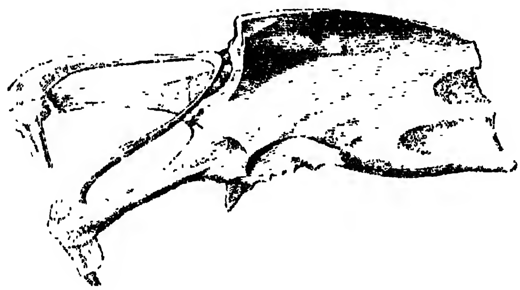
STRIGATELLA. [VOLUTIDÆ.]

STRIGIDÆ [OWLS, OWL TRIBE], the family name for the nocturnal birds of prey, the *Ægolians* of Vieillot.

This natural family have large heads and great projecting eyes directed forwards, and surrounded with a circle or disk (more or less developed according to the nocturnal or comparatively diurnal habits of the species) formed of loose and delicate feathers; a raptorial beak; crooked claws; and a downy plumage, generally spotted, powdered, or barred with different shades of brown and yellow.

ORGANIZATION.

Mr. Yarrell, in his paper on the *Anatomy of Birds of Prey* (*Zool. Journal*, vol. iii.), points out the diminished extent of surface and power in the sternum of the Owls as compared with that of the Peregrine Falcon. [FALCONIDÆ, vol. x., p. 163.]

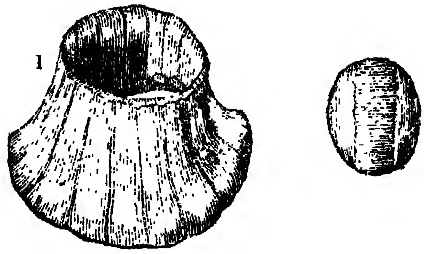


i Owl, Strix Stridula. (Yerell.)

A ... s, that from the loose and soft nature of ... in these birds, as well as their deficiency in ... and bone, rapid flight is denied them as useless, if not dangerous, from the state of the atmosphere at the time they are destined to seek their food; but, he adds, they are recompensed for this loss, partly by their acute sense of hearing, from an extension of the posterior edge of the cranium forming a conch, coupled with a very large external orifice; and partly by the beautifully serrated exterior edge of the wing primaries, which, allowing them to range without noise through the air, enables them to approach unheard their unsuspecting victim, which falls a prey to the silent flight and piercing eye of an inveterate enemy. He further remarks, that some increase and variation will be found in the strength and form of such of the owls as depart from the type of the true nocturnal bird. In the snowy owl and short-eared owls, which are described as occasionally taking their food by day, the furcula, Mr. Yarrell observes, is stronger and less angular in proportion than in the wood and barn owls. The trachea, he tells us, of the different species of owls so nearly resembles the same part in the falcons, that a separate description is unnecessary, and the same may be said generally of the œsophagus, stomach, and intestines, as the similarity of food would appear to require. Mr. Yarrell found the two cœcal appendages ...siderably developed in the species of Strix; in the Barn ...wl (*Strix flammea*), as well as in the Short-eared owl, they are, he states, small at their origin, afterwards dilated, and each 1¾ inch in length. The crop is large, and the stomach or gizzard is considerably muscular notwithstanding the nature of their living prey.

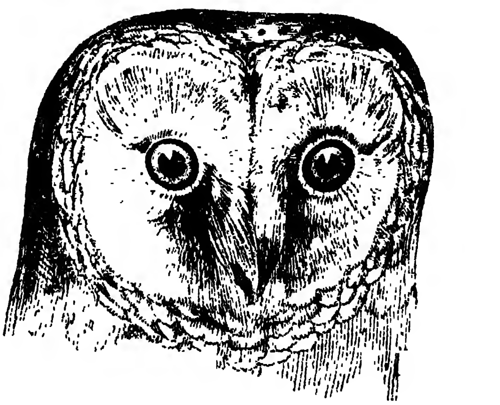
Brain, Nervous System, and Senses.—The brain is well developed in this family, and the senses of sight, hearing, taste, and smell, especially the two former, are enjoyed in a considerable degree of perfection.

Sight.—Mr. Yarrell observes (*loc. cit.*) that the external form of the bony ring in the Golden Eagle [FALCONIDÆ, vol. x., p. 165] will be found to extend through all the species of every genus of British birds, except the owls, in all of which it is concave. The bony ring of the Snowy Owl has fifteen plates forming the circle, and they are considerably lengthened. The transparent cornea being placed as it were at the end of a tube, is thus, he remarks, carried forward beyond the intervention of the loose and downy feathers of the head.



1, Bony ring of a S... anterior surface, less ... 2, Crystalline le... of the same bird, a, the ... an the posterior one. (Yarrell.)

It is this position of the eyes, observes the same author, giving a particular fulness and breadth to the head, which has gained for the owl the intellectual character universally awarded to it. The concave facial disk of feathers with which they are surrounded materially aids vision by concentrating the rays of l...

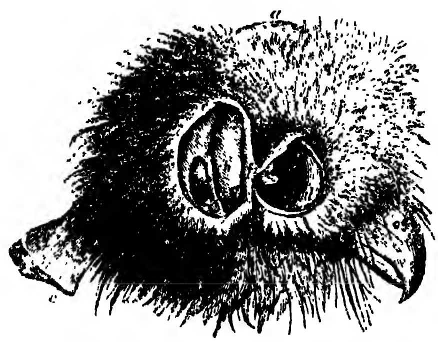


Mr. Yarrell goes on to observe, that the extent of vision enjoyed by the Falcons is probably denied to the Owls, but their more spherical lens and corresponding cornea give them an intensity better suited to the opacity of the medium in which their power is required to be exercised. 'They may be compared,' says he, 'to a person near-sighted, who sees objects with superior magnitude and brilliancy when within the prescribed limits of his natural powers of vision, from the increased angle these objects subtend.'

In the museum of the Royal College of Surgeons in London, No. 1755 of the *Physiological series* of preparations, is the eye of the Great Horned Owl (*Bubo maximus*), from which the cornea, humours, and a lateral section of the tunics have been removed, showing the remarkable prolongation of the anterior segment of the eye, which assumes in consequence a tubular form. The horny plates of the sclerotica are coextended with this segment to maintain its peculiar shape, and to afford a firm basis for the support of a very large and prominent cornea. The marsupium may be observed to be of small proportional size, consisting of seven slightly converging plicæ. The sclerotica, forming the posterior segment of the eye, is very thin. The vitreous and crystalline humours of the eye of the same species are prepared in No. 1749 of the same series, to show that the vitreous humour has a distinct capsule, part of which is reflected from its outer surface. No. 1750 is the crystalline lens of an owl, showing its great convexity adapted to the small distance at which objects are visible to this nocturnal bird at the time when it goes in quest of food. A longitudinal section of the crystalline lens of an owl, showing its f...m and laminated structure, is prepared in No. 1751. No. 1798 shows the eyeball (*membrana nictitans*) and its muscles, with the external eyelids and Harderian gland

of the Great Horned Owl. In consequence of the limited motion of the eyeball, arising from its bulk as compared with the orbit, the muscles are of small size. Those of the *membrana nictitans* are, on the contrary, well developed. Bristles are placed in the puncta lachrymalia, and in the duct of the Harderian gland. No. 1799 is the right side of the head of the Horned Owl (*Otus auritus*), showing the three eyelids in situ. The two horizontal are provided with plumose cilia; the third, or nictitating eyelid, is more obliquely placed in the owls than in other birds, and sweeps over the eye downwards as well as outwards, in which motion it is usually accompanied by the upper eyelid. The tarsal cartilage is nevertheless found only in the lower eyelid. A white bristle is passed through the duct of the Harderian gland, and a black one through one of the puncta lachrymalia and the lachrymal duct to the nose. (*Catalogue*, vol iii.)

Hearing.—This sense appears to be very acute in the *Strigidæ*: they not only look, but listen for prey. No. 1581 of the same series, in the same museum, is a section of the head of the last-mentioned species, showing the organ of hearing of the right side. The membrana tympani is lodged, in this tribe of birds, at the bottom of a wide but moderately deep external meatus, which is guarded by an anterior fold of integument, and further provided with a well developed auricular circle of feathers, which together fulfil the functions of an external concha. The drum of the ear is very thin and transparent; its vibrations are conveyed to the labyrinth by a single ossiculum, as in reptiles. The membrane closing the foramen ovale, to which the basis of the columella is attached, the vestibule, and the three semicircular canals, are shown; the two smaller and external canals are laid open where they open into each other in the middle of their course. Bristles are placed in both Eustachian tubes, which communicate together at their nasal terminations, as in the crocodile.



Head of a young White or Barn Owl. (Strix flammea.)

The down pressed backwards and forwards to expose the auditory passage and operculum. *a*, cranium; *b*, bill perforated by the nostril; *c*, neck; *d*, eye; *e*, termination of external skin surrounding the orifice of the ear; *f*, anterior flap, or opercular fold of the ear; *g*, part of the tympanic or quadrate bone; *h*, membrana tympani. (*Cat. Mus. Coll. Chir.*, vol iii.)

Foot of White or Barn Owl. (Strix flammea.)

Smell and Taste.—These senses appear to be developed nearly as they are in the *Falconidæ*. No. 1481 of the series in the same museum shows the tongue, larynx, and lower jaw of a horned owl injected. The tongue exhibits little vascularity, except at the membranous space intervening between the retroverted papillæ on its base and the glottis. The orifices of numerous glands may be observed on each side of the frænum linguæ. (*Catalogue*, vol. iii.)

Touch much the same as in the *Falconidæ*. Like theirs, the feet of the owls are formed for clutching and trussing their prey, in aid of which the external toe of the latter is capable of being directed either forward or backward.

Systematic Arrangement and Natural History.

Zoologists are generally agreed in the position assigned to the owls. In Belon and Gesner we find them next to the diurnal birds of prey. In the Work of the former the cuckoo indeed intervenes; but the external similitude between that species and the birds of prey accounts for the intervention. In Gesner the Shrikes come between the diurnal and nocturnal predacious birds.

Willughby divides the birds of prey into the diurnal and the nocturnal, placing in the last subdivision of the former the Butcher-Birds and Birds of Paradise. The latter he separates into two sections,—1, the horned or eared; 2, those without horns.

Brisson places the owls in the second section of his third order, which consists of birds with a short and hooked bill. This second section is defined as comprising species the base of whose bill is covered with feathers directed forwards.

The genus *Strix* stands among the *Accipitres* in the 'Systema Naturæ,' between the genera *Falco* and *Lanius*, which last concludes that order of Linnæus.

Latham places the owls at the end of the birds of prey, and so do Lacépède, Duméril, and Meyer. Illiger, on the contrary, makes the *Nocturni* the first of his order *Raptatores*. Cuvier makes them follow the *Diurnes*; and they immediately precede the *Passereaux*, among which last the Butcher-birds hold the first place in the first family, *Dentirostres*. Vieillot arranges the owls with the family name of *Ægolians*, under his second tribe (*Nocturni*) of his first order *Accipitres*.

M. Temminck places them at the end of his first order (*Rapaces*); and, in his 'Manuel' of European birds, divides the family of Owls into two divisions,—1st, the *Chouettes*, properly so called; 2nd, the *Chouettes Hibous*.

The 1st division, or *Chats-huants*, he subdivides into two sections, placing in the first section the *Accipitrine Owls*, or those which see well and pursue their prey by day; and in the second section the *Nocturnal Owls*, which hunt in no light stronger than twilight or moonlight, and conceal themselves during the day.

In the first section of the first division M. Temminck places the following species– *Striges Lapponica, Nyctea, Uralensis*, and *funerea*.

In the second we find *nebulosa, Aluco, flammea, passerina, Tengmalmi*, and *Acadica*.

Under the second division, *Chouettes Hibous*, distinguished by two tufts of feathers situated more or less forward upon the front, and capable of erection (whence their English appellation of Horned Owls) he arranges *Striges brachyotus, Bubo, Otus*, and *Scops*.

Mr. Vigors, who makes his first order (*Raptores*) consist of the families *Vulturidæ, Falconidæ, Strigidæ*, and *Gypogeranidæ*, says, in his paper 'On the Natural Affinities that connect the Orders and Families of Birds,' that if we search for the connection between the *Falconidæ* and the *Strigidæ*, we shall not fail to find their affinity apparent, as is usual, in the less typical part of the two groups. 'In the latter family some species may be observed gradually approaching the *Falcons* in their diurnal habits and the lateral position of the eyes; and, at the same time, deserting their own congeners in losing the large orifice to the ear, the disk that surrounds the face, and the egrets that decorate the head of the type of the family. The genus *Surnia*, Dumér., which includes the "*Chouettes Eperviers*" of the French naturalists, is the most accipitrine of the group. In addition to the approximation already pointed out, the bill and tail of this genus, more lengthened than those of the *Owls* in general, give it a still stronger resemblance to the *Falconidæ*. The group of *Buzzards* among the latter family appears to come most closely to the *Owls* in their slow and heavy

flight, the softness of their plumage, and their slothful and cowardly habits. The genus *Circus* of Bechstein in particular, of which our *Hen Harrier* gives a familiar example, may be observed to possess a peculiar elongation and erection of the face-feathers, which bears some resemblance to the disk that encircles the face of the *Strigidæ*, and it may therefore be particularised from among those groups, at least, which are most known to us, as exhibiting the nearest approach to *Surnia*.'

The same author observes, in the same paper, that when we search among the *Perchers* [INSESSORES] for that point where they approximate the *Owls*, we find in the *Caprimulgus* of Linnæus [GOATSUCKERS] a group whose general appearance and habits point out the affinity. 'The nocturnal and predatory manners of this genus, the hawking flight, the legs feathered to the talons, the large ears and eyes, the very disk that surrounds the face, and the pectination of the external quill-feathers, observable in some of the species, the general softness of the plumage, together with its peculiarly striking colour and markings, produce a similarity between it and *Strix* that has attracted the eye of the common observer no less than of the naturalist. The provincial names of this genus have generally a reference to this resemblance; while the earlier scientific describers of the different species have for the most part ranked them with the *Owls*. I know not whether the singular character observable in some of the species of this family, the serrated nail of the middle toe,* may not be cited as an additional proof of their approach to the *birds of prey*. The strong talons of the latter are lost in *Caprimulgus*; but a construction of similar import (for the serration of the nail appears capable of being applied to the purposes of seizure only) preserves, though faintly, the resemblance. May we not almost venture to affirm that this apparently trivial appendage is an instance of that beautiful shading by which Nature softens down the extremes of her neighbouring groups, one of those minute and delicate touches by which she marks at once an affinity and deviation? But while we may discern at a glance the general approximation of these two families, we must at the same time acknowledge that they stand in need of an intermediate link to give them a closer connection. The weakness of the bill and of the legs and feet of the *Caprimulgus* still keeps it at some distance from the *Owls*, in which the same members are comparatively strong, while the wide gape of its mouth serves to divide the families still further. A connecting link has been however supplied by an Australasian group, *Podargus* of M. Cuvier, which harmonises these discrepant characters. We have an opportunity of observing, among the specimens in the collection of the Society, how far the bill of this extraordinary genus combines the different forms of that of the two genera, and how far the legs, still maintaining the characteristics of *Caprimulgus*, such as the unequal length of the toes, are related to those of *Strix* by their superior robustness. Here indeed there is a beautiful gradation of affinities. All the front toes of *Caprimulgus* are united by a connecting membrane as far as to the first joint; those of *Strix* are divided to the origin; while those of *Podargus* partake of the characters of both, in having the middle toe connected with the outer, but divided from the inner. Again, as I have already remarked, *Caprimulgus* has the nail of the middle toe dilated and serrated, *Strix* has it, generally speaking, undilated and entire at the margin; but in *Podargus* the same part displays the singular dilatation of the one, and the marginal integrity of the other. It is difficult to say to which of these groups it comes nearest, until further and more accurate accounts than we at present possess of its food and economy may determine its actual situation. At present it remains osculant between the two families, and may decidedly be pronounced the immediate passage from the *birds of prey* to the *Perchers*.' (*Linn. Trans.*, vol. xiv.) In the 'Portraits d'Oyseaux,' 1657, the *Strix Caprimulgus*, *Fur nocturnus* (Goatsucker), immediately follows the *Owls*.

Mr. Swainson states that the divisions of the *Strigidæ* made by modern ornithologists can all be referred to one or other of the following groups:—1, Typical *Owls*, having the facial disk very large and complete, with large ears and (in general) an ample operculum; 2, Horned *Owls*, furnished with egrets and a large facial disk, but having only small or moderate-sized ears; and 3, *Diurnal* or *Hawk Owls*, where the conch of the ear is comparatively small, and is destitute of an operculum: the head has no egrets, and the facial disk is imperfect or obsolete. The first he considers the typical group; the second, the subtypical; and the third, the aberrant group.

The *Striginæ*, or typical owls, are, Mr. Swainson thinks, well represented by the common white species. The head is, he remarks, uncommonly large, and the facial disk of great circumference; the extent of the latter is marked by a dense semicircle of rigid narrow feathers, forming a sort of collar, with turned ends, lying close upon each other in the manner of scales. The aperture of the ear, which is within this collar, is large, measuring, he says, in the Brown Owl, more than an inch in length. This is protected by an operculum, which is sometimes much larger (as in *Strix flammea*) than the aperture, and sometimes nearly of the same size. He does not however regard these differences as *generic*. Owls of this group are, he observes, eminently nocturnal, and their geographic distribution, as is usual in all pre-eminent types, is very wide; the white owl, under slight variations of colour, having been found in all the temperate parts of America, in the sultry groves of India, and even in Australia. Without attempting to arrange the subgenera of this group in their natural order of succession, a task, he remarks, of great difficulty, he proceeds to enumerate such of the subordinate groups as appear to him either to lead to or represent the other genera. He makes it the primary distinction of the birds of this group, that two out of the three primary characters, viz. the facial disk, the operculum, and the great development of the ear, should be found in all; hence he includes in it the common long and short-eared owls of Britain, as aberrant forms or subgenera, representing the rasorial or crested type of the genus. Mr. Swainson finds a third type in the *Strix Tengmalmi*, to which, he thinks, we should probably refer the various small species of Europe (still but imperfectly known under the name of *Strix passerina*), together with those of temperate America. These latter owls, he observes, are known by their small size; short feet, thickly covered with feathers to the root of the claws; and by the operculum being long and narrow, the conch forming almost a semicircle. This he considers to be the tenuirostral division of the genus, and gives it the subgeneric appellation of *Scotophilus*. *Strix cinerea*, with its long tail, holds, in his opinion, an intermediate station between *Strix Tengmalmi* and *Strix stridula*, and becomes the type of his subgenus *Scotiaptex*, the length and graduated shape of the tail separating it both from *Scotophilus* and *Strix*.

Mr. Swainson retains the antient name of *Asio* for the second genus, remarking that *Noctua* has already been appropriated by Linnæus to an extensive group of nocturnal lepidopterous insects. Here he places the true Horned Owls, furnished with conspicuous egrets above the eyes, and with large disks and ears. The facial disk, in this group, is still large, but it is, he observes, more or less imperfect, especially above the eyes. The grand character of this division is the possession of egrets. Mr. Swainson has little doubt, judging from published figures, that all the subgeneric groups exist, but he here notices two only. The Great White Horned Owl (*Heliaptex Arcticus*), in his opinion, evidently intervenes between *Asio Virginianus* and *Nyctea candida*. 'It is, in fact,' continues Mr. Swainson, 'so closely connected with the latter, that, but for its egrets, both would stand in the same genus: the facial disk has now almost entirely disappeared; the head is not much bigger in proportion than that of a falcon of the same dimensions; and the ears are very small. Like the Great Cinereous Owl, which it seems to represent, its tail, although not much graduated, is longer than usual. Last of all come the little *Scops* Owls, a diminutive group in point of size, but of which there are many species. We are disposed to believe that these may form a subgenus of themselves, although we cannot at present detect any very prominent character by which they are separated from their congeners. They seem to differ indeed from the great horned owls above mentioned, by the superior length of their legs, and by the nakedness of their toes. From the hornless passerine owls of Europe (*Strix Tengmalmi*, &c.), which they seem to represent, they are at once known by the diminished size of their ears, and by their egrets; while, from the corresponding group in South America (*Nyctipetes*)

* 'The common *Barn-Owl* (*Strix flammea*, Linn.) possesses the same character of a serrated *unguis*, and some other species of the *Strigidæ* exhibit somewhat the rudiments of it, thus establishing still more closely the affinity of the groups under consideration.'

they are immediately recognised by the last of these characters. For the present therefore we may retain the group until the whole genus is properly analysed. Several species, apparently belonging to the subgenus *Scops*, are found in South America, and one in Western Africa. One of the most remarkably horned species is the *Asio superciliosus;* and there are several from India which have the *tarsi* or legs nearly naked.'

Mr. Swainson then comes to the aberrant group, composed, as usual, of three divisions, which he views as genera. In this group he places *Nyctea*, *Nyctipetes*, and *Surnia*.

Mr. Swainson rejects the genera *Noctua*, *Bubo*, and *Ulula*, and still hesitates at admitting *Syrnium*, being uncertain whether the brown owl [illegible] is really one of the types of the genus *Strix*. On the other hand he proposes *Scotiaptex*, *Scotophilus*, *Heliaptex*, and *Nyctipetes*.

In the following table the author gives his arrangement of the entire family:—

Strigidæ.—*The Owls.*

		Genera.
1. Typical group.—	Ears large, operculated, no egrets.	Strix.
2. Subtypical.—	Ears smaller, no operculum, egrets.	Asio.
	Ears small, no egrets or operculum, disk imperfect.	
Aberrant.—	Head small, claws feathered, tail short.	Nyctea.
	Head large, claws naked, tail moderate.	Nyctipetes.
	Head small, claws feathered, tail wedged. . . .	Surnia.

The same author observes that we know too little of the birds composing these groups to admit of their analogies being traced among other families, at least with precision. Nevertheless, he notices the indications of such analogies. 'Thus,' says he, 'the lengthened and more conic bill of the barn owl reminds us of the *Conirostres;* on the other hand the bill of *Asio Virginiana* (Virginianus) is described by Dr. Richardson as very strongly curved from the base, and with its cutting margin very obtusely lobed in the middle—a structure peculiarly belonging to dentirostral types. The short tail and piscatorial habits of the *Nyctea candida* sufficiently designate the aquatic type. The long-legged burrowing owl obviously represents the grallatorial order of birds and the gliriform quadrupeds; but whether it is the type of *Nyctipetes*, or one of its subgenera, we know not; while in the long-tailed hawk-owls of the genus *Surnia* we trace that great development of tail so conspicuous in rasorial types.' (*Classification of Birds*, vol. i.)

The following is the arrangement in the *Synopsis* at the end of the second volume of the work:—

Strigidæ.

Genera.

Strix, Linn. (Typical Owls.)

Subgenera:—*Strix; Scotiaptex; Scotophilus; Otus.*

Asio, Antiq. (Horned Owls.)

Subgenera:—*Heliaptex; Scops.* (Scops Owls.)

Nyctia, Sav. (Eagle Owls.)

Subgenera not defined.

Nyctipetes, Sw. (Sparrow Owls.)

Subgenera not defined.

Surnia, Dum. (Hawk Owls.)

Subgenera not defined.

The Prince of Canino, in his *Geographical and Comparative List of the Birds of Europe and North America*, gives the following arrangement of the—

Strigidæ.

Subfam. *a.* Surninæ.

Genera.—Surnia, Dum.; *Nyctea*, Bonap.; *Glaucidium*, Boie: *Athene*, Boie (*Nyctipetes*, Sw.); *Scops*, Sav.

Subfam. *b.* Buboninæ.

Genera.—Bubo, Cuv. (*Asio* and *Heliaptex*, Sw.); *Syrnium*, Cuv. (*Scotiaptex*, Sw.).

Subfam. *c.* Ululinæ.

Genera.—*Otus*, Cuv.; *Brachyotus*, Gould, *Ulula*, Cuv.; *Nyctale*, Brehm (*Scotophilus*, Sw.).

Subfam. *d.* Striginæ.

Genus, *Strix*, Linn.

The *Strigidæ* form the third family of the order *Accipitres* in the Prince's method. The *Falconidæ* compose his second family of that order. His fourth family, the first in his order *Passeres*, consists of the *Caprimulgidæ*.

Mr. G. R. Gray makes the *Accipitres Nocturni* the second suborder of his first order *Accipitres*. His third family, the first of that suborder, is formed of the *Strigidæ*, which are thus subdivided by him:—

Subfam. 1. Surninæ.

Genera.—*Surnia*, Dum. (*Syrnia*, Steph., *Strix*, Gm.); *Accaba*, Wagl. (*Surnia*, Cuv., *Strix*, Shaw); *Nyctea*, Steph. (*Noctua*, Cuv., *Nyctia*, Sw.); *Athene*, Boie (*Nyctipetes*, Sw., *Strix*, Daud.); *Huhua*, Hodgs.

Subfam. 2. Buboninæ.

Genera.—*Scops*, Sav. (*Scops*, Sav., *Asio*, Briss., *Otus*, Less., *Strix*, Linn.); *Lophostrix*, Less., *Ketupu*, Less. (*Cultrungius*, Hodgs., *Strix*, Gm.); *Bubo*, Sibb. (*Feliceps*, Barr., *Asio*, Antiq., *Ulula*, Bonap., *Heliaptex*, Sw., *Ascalaphus*, J. Geoff., *Strix*, Linn.)

Subfam. 3. Ululinæ.

Genera.—*Syrnium*, Sav. (*Scotiaptex*, Sw., *Ulula*, Briss., *Strix*, Linn.); *Otus*, Ray (*Asio*, Briss., *Brachyotus*, Gould, *Strix*, Linn.); *Urrua*, Hodgs.; *Nyctalops*, Wagl.; *Ulula*, Cuv. (*Strix*, Gm.): *Glaucidium*, Boie (*Strix*, Linn., *Noctua*, Cuv., *Athene*, Boie): *Nyctale*, Brehm (*Scotophilus*, Sw., *Nudipedes* et *Ptilipedes*, Less., *Strix*, Bechst., *Athene*, Boie); *Ninox*, Hodgs.

Subfam. 4. Striginæ.

Genera.—*Strix*, Linn; *Pholidus*, J. Geoff. (*Strix*, Horsf.); *Bulaca*, Hodgs.

Geographical Distribution of the Family.—Very wide; extending as high as the Polar Sea, where *Strix Nyctea* is recorded by E. Sabine as having been seen on the islands in the summer months, and by James Ross as having been observed about Victoria Harbour throughout the winter, where several pairs had bred in the preceding autumn; and as low at least as Port Famine in the Straits of Magellan (*Strix rufipes*, *Strix nana*, &c., King). Species are found in Europe, Asia, Africa, America, and in Australia.

Food. Birds and quadrupeds, and even fish (in the case of *Strix nyctea* and *Strix flammea*), according to the size of the species. Hares, partridges, grouse, and even the turkey, are attacked by the larger horned owls of Europe and America: while mice, shrews, small birds, snakes, and crabs suffice for the inferior strength of the smaller *Strigidæ*. Mr. Yarrell states that the short-eared owl (*Strix brachyotus*) is the only bird of prey in which he ever found the remains of a bat.

The species are numerous, and the British Museum contains a very fine collection of them. Our limits will not permit us to do more than notice a very few. The larger horned owls are described in the article BUBO.

EUROPEAN OWLS.

The common white or barn owl (*Strix flammea*) claims our first attention, from its typical nature.

Description.—*Male.*—Upper parts bright yellowish, varied with grey and brown zig-zag lines, and sprinkled with a multitude of small whitish dots, face and throat white; lower parts in some individuals rusty white, sprinkled with small brown dots; in others bright white, marked with small brownish points; in others again without the slightest appearance of spots; feet and toes covered with a very short down, more scanty on the toes; iris yellow. Length about thirteen inches.

In the *Female* all the tints are brighter, and more developed.

Young.—Covered with a thick white down, and remain long in the nest. Mr. Blyth states that the first set of feathers grows very slowly, and is not moulted till the second autumn.

Varieties.—Whitish, or entirely white.

This is the *Effraie*, *Fresaie*, and *Petit Chathuant Plombé* of the French; *Barbagianni*, *Alloco Commune e Bianco*, of the Italians; *Schleierkauz*, *Perlschlierkautz*, and *Perl-Eule* of the Germans; *De Kerkuil* of the Netherlands; *Barn Owl*, *White Owl*, *Church Owl*, *Gillihowlet*, *Howlet*, *Madge Howlet*, *Madge Owl*, *Hissing Owl*, and *Screech Owl* of the modern British; and *Dylluan wen* of the antient British.

Geographical Distribution.—Very wide. Common in England and Ireland, less common in Scotland. Not common in the Orkneys, but present in some of the islands. Found in Denmark, but said not to inhabit Sweden or Norway; generally spread over temperate Europe; found in Madeira; common in Loraine; extending in Africa from the north to the Cape of Good Hope; met with in India, Japan, and Australia?* African and Japanese individuals

* See post p. 122.

are, M. Temminck tells us, precisely similar to those of Europe; and those of North America (where it is found in the United States, but does not appear to visit the Fur-countries) differ only in having some slight tints of more sombre hue. Those of South America (the *Yellow Owl*) are different.

Habits, Food, &c.—Montagu says that this species is never known to hoot. Mr. Yarrell states that it screeches, but does not *generally* hoot. Sir W. Jardine declares that he shot one in the act of hooting; and that at night, when not alarmed, hooting is their general cry. It snores and hisses, and, like other owls when annoyed or frightened, snaps its bill loudly. Rats, mice, shrews, young birds, and beetles form their food, and the mice especially suffer when the white owl has a young brood to sustain. It has been seen to catch fish. This owl frequents churches, old buildings, and barns, often breeding in the latter, as well as in hollow trees near farmyards and villages. The nest is but a rough one, and the female lays three or four white eggs more oval than those of the brown or ivy owl, and not so large. Young have been found so late as July, September, and even December. Mr. Blyth, in the *Field Naturalist's Magazine* (vol. i.), throws some light upon this. 'A nest of the barn owl, last summer,' says he, 'in this neighbourhood (Tooting) contained two eggs, and when these were hatched two more were laid, which latter were probably hatched by the warmth of the young birds; a third laying took place, after the latter were hatched, and the nest at last contained six young owls of three different ages, which were all reared.' Mr. Yarrell states that he has frequently been told by boys in the country, that they had found eggs and young birds at the same time in this bird's nest. The food is generally swallowed whole, and the bones and fur or feathers rejected in pellets called castings, as indeed is generally the case with this family.

In captivity the Barn-Owl is sociable with other birds, but will sometimes, like the dogs, hide what remains of its meat.

Strix flammea.

Surnia Uralensis.—*Description.*—Face whitish, tail much graduated, much longer than the wings; all the plumage striped with large longitudinal spots and streaks.

Old of both Sexes.—Head of considerable size, face very large, well feathered, greyish white, marked with some blackish hairs; a large circle of white feathers spotted with brownish black, takes its origin on the forehead and frames in the whole face; top of the head, nape, back, and wing-coverts marked with great longitudinal spots, which are disposed on a whitish ground; throat, front of the neck, and all the lower parts whitish, marked on the middle of each feather with a large longitudinal brown stripe; quills and tail-feathers banded with brown and dirty white alternately; seven of these bands may be counted on the tail; beak yellow nearly hidden in the long hairs of the face; iris brown, tarsi and toes covered with white hairs marked with small brown points; claws very long, yellowish. Length of tail ten inches and some lines; total length about two feet.

Young of the Year.—All the ground-colour of the plumage bright brownish-grey; the spots and stripes on all the lower parts ashy-brown; upper parts irregularly spotted with ashy-brown and light red, and variegated with oval white spots; wings and tail transversely banded with grey the seven bands of the tail whitish ash.

This is the *Strix Uralensis* of Pallas; *Strix liturata* Retz; *Strix macroura*, Natterer; *Strix macrocephala* Meisner; *La Chouette des Monts-Urals*, Sonnini; *Ural Owl*, Latham; *Die Ural Habichtseule*, Bechstein: *Habichts-eule*, Naumann; *Uralischer und Grossköpfiger Baumkautz*, Brehm.

Geographical Distribution.—Arctic regions of the Old World, Lapland, North of Sweden, Norway and Russia. Livonia and Hungary, and Japan. Very rare in the eastern parts of Germany; very accidentally found elsewhere. Mr. Gould regards it as one of the rarest European Owls.

Habits, Food, &c.—Leverets, rats, mice, ptarmigan, and small birds. The nest is formed in the holes of trees, often near the habitations of man. Mr. Gould states that the number of eggs is two; M. Temminck says three or four. they are pure white.

Surnia Uralensis.

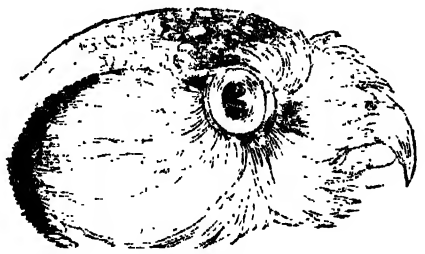
Surnia funerea.—*Description.*—*Male.*—Forehead dotted with white and brown; a black band takes its origin behind the eyes, includes the orifice of the ears as in a frame, and terminates on the sides of the neck; upper parts marked with brown and white spots of various forms; on the borders of the wings are similar white spots disposed on a brown ground; throat whitish; the other lower parts white, transversely striped with ashy brown; at the insertion of the wings a great spot of blackish brown; tail-feathers ashy brown, striped at considerable distances with transversal narrow zigzags; bill yellow varied with black spots according to age; iris bright yellow: feet feathered to the claws. Length of tail six inches and some lines. Total length upwards of fourteen inches (Temm.); Richardson says eighteen inches.

The colours of the female are less pure than those of the male, and she is rather larger.

This is the *Strix Ulula*, Linn.: *Strix funerea*, Gmel.; Forst.; *Strix Hudsonia*, Gmel.; *Strix Canadensis et Freti Hudsonis*, Briss.; *Strix Hudsonia*, Wils.: *Strix nisoria*, Meyer; *Chouette de Canada et Chouette Epervière, ou Caparacoch*, and *Chouette à longue queue de Siberie*, Buffon (*Enl.* 463, a very good figure of this species, under the erroneous name of the Ural Mountains Owl); *Chouette Epervière*, Sonn.; *Sperbereule*, Meyer: Naum.; *Habichts eule*, Bechst.; *Plattköpfige* and *Hochköpfige Habichtseule*, Brehm.; *Hawk-Owl* of Pennant and Wilson; *Little Hawk-Owl* of Edwards; *Canada Owl* of Latham. *Paypaw theecawsew*, or *Cobadecootch* of the Cree Indians; *Theechazza* of the Copper Indians and Chepewyans; and *Ood no hezoot* of the Esquimaux.

Geographical Distribution.—The Arctic Circle and Arctic regions of both continents; sometimes seen as a bird of passage in Germany, more rarely in France, but never in the southern provinces. In Britain it does not appear to have been seen; but one was taken in a collier a few miles off the coast of Cornwall in 1830.

Habits, Food, &c.—The visual organs of this species are more able to bear the light of day, at least in dull weather, and, like the Snowy Owl, it hunts frequently in the daytime. The smaller head and less perfect facial disk, combined with these habits, have obtained for it the name of *Hawk-Owl*.



Profile of Hawk-Owl.

Dr Richardson says that 'It remains all the winter in high northern latitudes, and is rarely seen so far south as Pennsylvania, and then only in severe winters. Wilson saw only two specimens in the United States. It is a common species throughout the Fur-countries from Hudson's Bay to the Pacific, and is more frequently killed than any other by the hunters, which may be partly attributed to its boldness and its habit of flying about by day. In the summer season

Hawk Owl.

it feeds principally on mice and insects; but in the snow-clad regions, which it frequents in winter, neither of these are to be procured, and it then preys mostly on ptarmigan. It is a constant attendant on the flocks of ptarmigan in their spring migrations to the northward. It builds its nest on a tree, of sticks, grass, and feathers, and lays two white eggs. When the hunters are shooting grouse, this bird is occasionally attracted by the report of the gun, and is often bold enough, on a bird being killed, to pounce down upon it, though it may be unable, from its size, to carry it off. It is also known to hover round the fires made by the natives at night.' (*Fauna Boreali-Americana.*)

Surnia nyctea.—Description.—Head small in proportion, bill black, entirely hidden by the hairy feathers at its base; plumage snow-white, but more or less variegated with transverse brown spots or stripes; the younger the bird is, the larger and more numerous are these spots and stripes. Very old individuals are pure white, without any brown spot; iris fine orange yellow; feet very well covered, so as to look almost woolly to the claws; tail rounded, not much exceeding in length the extremity of the wings. Length 24 or 25 inches. Female considerably larger than the male.

Young at the time of departure from the nest.—Covered with brown down: the first feathers bright brown.

This is the *Strix nyctea* of Forster, Latham, and Gmelin; *Strix candida* of Latham; *Strix nivea* of Daudin; *Chouette Harfang* of Buffon; *Chouette Blanche* of Le Vaillant; *Allocco Diurno* of 'Stor. degl. Ucc.;' *Schneekauz* of Bechstein; *Sneeuwuil* of Sepp; *Nordicher Schneekautz* and *Schnee Eule* of Brehm.; *Ermine Owl* and *Snowy Owl* of Latham; *Great White Owl* of Edwards; *Snow Owl* of Wilson; *Wapow Keetho* or *Wapohoo* of the Cree Indians; and *Ookpeegnak* of the Esquimaux.

Geographical Distribution.—Arctic regions of the Old and New World, Iceland, Sweden, Norway, Lapland, and the north of Europe generally. The Shetland Isles possess it, but, some think, in winter only. In the Orkneys it appears to be accidental. It has been shot in Scotland, England, and Ireland, and has been occasionally seen in Germany: in Holland a young bird was seen in the winter of 1802. It does not appear to have been seen in France. Dr. Richardson states that it frequents in summer the most arctic lands that have been visited, but retires with the ptarmigan, on which it preys, to more sheltered districts in the winter. 'Even in the latter season however,' says that author in continuation, 'it is frequently seen within the confines of the Arctic Circle; though it is not very uncommon at the same period in Canada and the northern parts of the United States; and now and then it has been known to wander as far south as Florida. . . . It hunts in the day; and indeed unless it could do so, it would be unfit to pass the summer within the Arctic Circle. When I have seen it on the barren grounds, it was generally squatting on the earth, and if put up, it alighted again after a short flight; but it was always so wary as to be approached with great difficulty. In the woody districts it shows less caution, and, according to Hearne, has been known to watch the grouse-shooters a whole day for the purpose of sharing in the spoil. On such occasions it perches on a high tree, and when a bird is shot, skims down, and carries it off before the sportsman can get near it. It preys on lemmings, hares, and birds, particularly the willow-grouse and ptarmigan. Mr. Hutchins says that it eats carrion; and Wilson informs us that it is a dexterous fisher, grasping its finny prey with an instantaneous stroke of the foot as it sails along near the surface of the water or sits on a stone in a shallow stream. I have seen it pursue an American hare on the wing, making repeated strokes at the animal with its foot; but on that occasion, through the intervention of an Indian, it ws driven from its quarry. It makes its nest on the ground, and lays three or four white eggs, of which two only are in general hatched. In winter, when this owl is fat, the Indians and white residents in the Fur-countries esteem it to be good eating. Its flesh is delicately white.' (*Fauna Boreali-Americana.*) M. Temminck states that it builds its nest on scarped rocks, or on the old pines of the glacial regions; and that it lays two eggs, marked with black spots, according to M. Vieillot, but white, according to all other naturalists. William Bullock appears to have been the first who recognised this species as a British bird during his visit to the Orkneys and Shetlands in the summer of 1812. He states that one, wounded on the Isle of Balta, disgorged a

young rabbit whole; and that one in his possession when he wrote, had in its stomach a sandpiper with its feathers entire.

N.B. The large white owl of Africa is no longer considered to be identical with this species.

Specimens in different stages of plumage are generally to be seen in the garden of the Zoological Society in the Regent's Park.

The following are also European species:—*Bubo maximus**, *Bubo Ascalaphus*, *Otus vulgaris**, *Otus brachyotos**, *Scops Aldrovandi**, *Surnia cinerea*, *Ulula nebulosa*, *Syrnium Aluco**, *Noctua nudipes** (Gould—*Strix nudipes*, Auct.), *Noctua Tengmalmi**, and *Noctua Passerina** (Gould—*Strix passerina*, Auct.).

Those marked * are in the Catalogue of British Birds. Mr. Yarrell gives *Strix passerina* and *Noctua nudipes*, Gould, as synonyms.

ASIATIC OWLS.

Example, *Strix badia*, Horsf.

Description.—General colour of the upper parts of the head, back, wings, and tail, chesnut-brown, with a bright fulvous lustre irregularly diffused over it, showing itself more strongly in particular patches; on the under parts, from the neck to the vent, the brown colour is greatly diluted, and the fulvous lustre alternates with patches of Isabella yellow. All the parts dotted with brown; ornamental collar round the neck, consisting of a compound series of delicate white plumes, terminated by a band of deep chesnut, the accidental derangements of which exhibit a beautiful alternation of the two colours: circle about the eyes and the forehead of a pale brown tint; plumes which bound the collar above and below nearly white; bill yellowish, moderate; feet thickly covered with fulvous silky plumes; toes brownish, and nearly naked, claws yellowish; quills and tail-feathers broadly banded transversely with blackish brown. Total length from the bill to the extremity of the tail, to which the wings almost reach, eleven inches; to the end of the claws, twelve inches.

This is the *Wowo-wiwi* or *Kolong-wiwi* of the Javanese.

Dr. Horsfield, from whose *Zoological Researches* the description is taken, states that this species, whose head is proportionally large, has a general resemblance to *Strix flammea* in the distribution of its colours and external marks. The upper parts are, he observes, generally dark, and the lower of a paler hue. The neck is surrounded by a loose ornamental collar; the plumes encircling the eyes are rigid, and disposed with perfect regularity, and the legs are entirely covered. A resemblance also exists, he adds, in the lustre of their covering.

Locality.—Java, in the closest forests of the district of Pugar, and the ranges of low hills south of the capital of Surakarta. (Horsf.)

Habits, Food, &c.—The habits of this species are nocturnal. Dr Horsfield, *loc. cit.*, speaking of *Strix Javanica* (which, he says, his specimens show to be merely a variety of *Strix flammea*), remarks, that it is the only species of this division which is occasionally found near villages and dwellings. 'It is not however a favourite with the natives; various superstitious notions are also in Java associated with its visits; and it is considered in many parts of the island as portending evil. The other species of this division are by no means common, and the *Strix badia* is one of those that are most rarely met with. It never visits the villages, but resides in the closest forests, which are the usual resort of the tiger. The natives even assert that the *Wowo-wiwi* approaches this animal with the same familiarity with which the Jallak (the Pastor Jalla of our catalogue) approaches the Buffalo, and that it has no dread to alight on the tiger's back.' Dr. Horsfield adds, that it is never seen in confinement.

The same author states that eight species of owls from Java have been arranged in the museum at the India House; three eared-Owls, and five smooth-headed.

AFRICAN OWLS.

Example, *Strix Capensis*, Smith.

Description.—Red brown above, scantily sprinkled with small white spots, pale ochreous red below, marked with small heart-shaped spots; face yellow-brown; cervical collar pale buff-orange, with many of the feathers, particularly of its inferior portion, tipped with brown; quills subochreous, banded with brown; eyes brownish-black; bill and feet livid or straw-yellow; legs long, upper half of the tarsi covered with feathers, lower half and toes covered with small flat circular scales, upon which are a few strong rigid bristles, claws long, dark horn-colour, slightly covered and pointed. Length 16 inches. The whole of the plumage has a silky gloss.

Female considerably larger than the male, and with the colours less clear.

Young.—Down of the nestlings dull cream-yellow, plumage of the upper parts during the first year darker than in adult birds. (Smith.)

Dr. Smith states that the few specimens which he saw were obtained near Cape Town, close to Table Mountain, in the rocky precipices of which they were said to have concealed themselves during the day. He adds, that the colonists recognise this bird as distinct from the *Doodvogel* (*Strix flammea*), which occurs abundantly throughout the whole of South Africa, and that it is at once to be distinguished by its size from *Strix badia* of Horsfield, the species to which it is by colours most nearly allied.

Dr. Smith also figures and describes another typical owl, *Athene Capensis*, described by him under the name of *Noctua Capensis*, in the *South African Quarterly Journal*, 2nd series, 1834.

The length of this species is $9\frac{1}{2}$ inches, and the bird from which the description was taken was shot in the depths of one of the forests of the eastern district of the Cape Colony. It was the second specimen of the species he had seen; the first was also killed in a forest of the same district in 1824.

The same author figures and describes in the same work (*Illustrations of the Zoology of South Africa*) an eared owl, *Otus Capensis*; total length from tip of bill to tip of tail, 15 inches: general colour, brown above, and dappled beneath on the lower parts; the female rather larger than the male, and the colours the same in both. He states that this is a rare bird in the south of Africa, and, as far as he knows, has never been found but in marshy situations. 'It passes the day among the rushes, reeds, or long grass, and five or six individuals are sometimes found congregated together. When disturbed, they fly only a short distance before they attempt to conceal themselves again, and it is not before they have been several times flushed in succession that they seek safety in a prolonged flight. They feed upon mice, lizards, and water-insects.'

AMERICAN OWLS.

Our limits will only permit us to notice, in addition to the species above recorded, which are common in Europe and America, the well-known burrowing little owl (*Noctua cunicularia*). Mr. Darwin states that this species, on the plains of Buenos Ayres, exclusively inhabits the holes of the bizcacha or viscacha [CHINCHILLIDÆ, vol. vii., p. 88]; but that in Banda Oriental it is its own workman. 'During the open day, but more especially in the evening,' says this acute observer, 'these birds may be seen in every direction, standing frequently by pairs on the hillocks, near their burrows. If disturbed, they either enter the hole, or, uttering a shrill harsh cry, move with a remarkably undulatory flight to a short distance, and then turning round, steadily gaze at their pursuer. Occasionally in the evening they may be heard hooting. I found in the stomachs of two which I opened, the remains of mice, and I one day saw a small snake killed and carried away. It is said these latter animals are their common prey during the daytime. I may here mention, as showing on what various kinds of food owls subsist, that a species that was killed among the islets of the Chonos Archipelago had its stomach full of good-sized crabs.' (*Journal of Researches in Geology and Natural History.*)

AUSTRALIAN OWLS.

Mr. Vigors and Dr. Horsfield, in their *Description of the Australian Birds in the Collection of the Linnean Society* (*Linn. Trans.*, vol. xv.), record three species of owls belonging to the genera *Noctua* and *Strix*.

Noctua.

Example, *Noctua Boobook*.

Description.—Brown above, with a few yellowish-white spots; white beneath, varied with ferruginous spots; toes hairy.

This is the *Strix Boobook*, *Boobook Owl* of Latham.

According to Mr. Caley, 'The native name of this bird is *Buck-buck*. It may be heard nearly every night during winter uttering a cry corresponding with that word. Although this cry is known to every one, yet the bird itself is known but to few; and it cost me considerable time and

trouble before I could satisfy myself respecting its identity. The note of the bird is somewhat similar to that of the European *cuckoo*, and the colonists have hence given it that name. The lower order of the settlers in New South Wales are led away by the idea that everything is the reverse in that country to what it is in England; and the *cuckoo*, as they call this bird, singing by night, is one of the instances which they point out.'

Noctua maculata, described by the same authors, much resembles the species just noticed, but they are inclined to consider it distinct.

Strix.

Example, *Strix flammea*?

Mr. Vigors and Dr. Horsfield observe that this bird varies from our European species in the buff colour being considerably darker, and the spots on the *abdomen* being larger and more deeply marked than is usual in our own. They add however that in our species there is considerable variety; and as they had an opportunity of examining a single specimen only from New Holland, and that in an inferior condition, they did not wish to state with any confidence an opinion as to the identity of these birds.

Fossil Owls.

Remains of fossil owls have been found in the gypsum of the Paris basin (first lacustrine portion of the tertiary series, Eocene of Lyell) in company with extinct species of extinct genera of *Pachydermata*, and extinct species belonging to existing genera of *Carnivora, Marsupialia, Rodentia*, and of other birds referrible to the Buzzard, Quail, Woodcock, Sea-Lark (*Tringa*), Curlew, and Pelican. Reptiles (fresh-water tortoises and crocodiles), and Fishes. Two kinds of owl belonging to existing species occur in the gypsum cavities at Köstritz, together with sheep or roe, fox, weasel, squirrel, field mouse, common rat, hamster, bat, mole, hare, rabbit, frog, domestic cock, and man (existing species), mixed confusedly with the bones of the extinct animals, rhinoceros, &c. (*Reliquiæ Diluvianæ*, p. 168.)

STRIKE, a term much employed by modern geologists, after the example of Professor Sedgwick, to denote the direction of a horizontal or level line, in the surface of inclined or vertical strata, mineral veins, dykes, &c. If the strata be vertical, their *strike* corresponds with the surface *direction* of the beds; the same happens if the strata be inclined at any angle to the horizon, provided the surface of the ground be level; but in general the outline of the edges of the strata differs from the strike. The dip, or line of greatest inclination of strata, is always at right angles to the strike, so that in conical or elliptical elevations of strata the strike is a curved line, continually varying in direction. But, generally, viewed on a large scale, irregularities of this nature vanish, and a whole great mountain-region, as North Wales, South Wales, or North Devon, manifests one predominant general strike, corresponding with one, or more than one *axis of movement*, upon which the displaced strata have been bent or broken.

STRING-COURSE, a projecting *course* of masonry forming a *string* or horizontal line on the face of a wall, and consisting of a series of mouldings, as in Gothic, or a flat surface (either plain or enriched), as in Italian architecture. In both styles, string-courses admit of great variety, and contribute very much to decoration, while they are in themselves essential members, inasmuch as they serve to define the internal division of the building, corresponding with the floors of the several stories; and by separating one tier of windows from another, to mark each as a distinct portion of the general composition, complete as regards itself, though secondary to the other. While they separate, they serve also to connect and combine the successive stages of a building; and to produce a due mixture of horizontal with perpendicular lines.

In Gothic architecture, the upper surface of a string-course is almost invariably splayed or sloped in order to shoot off rain, the projection being usually such that the wet would else lodge upon it. The string-course itself consists sometimes of only a few narrow and plain mouldings, at others of a variety of them separated by one or more considerable hollows. In the later or perpendicular style of Gothic, the string-course is frequently made a broad tablet, not only richly moulded, but ornamented with sculptured blocks, heads of animals, shields, &c. placed at intervals in the principal cavetto or hollow; besides which, additional carved ornament is occasionally introduced on the surfaces between the other mouldings. In some instances the string-course is so enlarged as to become a sort of frieze or horizontal pannel filled up with a pattern of tracery, or with lesser pannels, &c. carved on it; of which kind East Barsham Manor-house, and the parsonage at Great Snoring, afford some fine examples.

In Italian architecture, the string-course (*Fascia*, Ital.; *Cordon*, French; *Band*, German) is either quite plain, or more or less decorated according to the character of the floor to which it belongs. That which crowns a basement floor is seldom more than a *plat-band* or plain surface, while the upper ones form ornamental fascias, enriched with guilloches, frets, &c. either with or without mouldings. The Travellers' and Reform club-houses, London, are remarkable for their beauty, in regard to these members, and for the richness and finish which they contribute to the respective designs.

STROBILO'PHAGA, M. Vieillot's name for the *Corythus* of Cuvier, which has the priority. [FRINGILLIDÆ, vol. x., p. 482.]

STRO'MBIDÆ, a family of marine testaceous gastropods, belonging to the *Alata* of Lamarck and the *Angyostomata* of De Blainville.

The genus *Strombus* of Linnæus is placed in the *Systema Naturæ* between *Buccinum* and *Murex*; and is divided into the following sections:—

* *Digitati*; the lip with linear laciniæ.

Species:—*Strombi Fusus, Pes Pelecani, Chiragra, Scorpius, Lambis, Millepeda.*

** *Lobati.*

Species: —*Lentiginosus, Gallus, Auris Dianæ, Pugilis, Marginatus, Luhuanus, Gibberulus, Oniscus.*

*** *Ampliati.*

Species:—*Lucifer, Gigas, Latissimus, Epidromis, Canarium, Vittatus, Succinctus, Spinosus, Fissurella, Dentatus.*

**** *Turriti*: with a very long spire.

Species:—*Tuberculatus, Palustris, Ater,* and *Lividus.*

Lamarck's family of *Alata*, or Winged Zoophagous Trachelipods, stands between the *Canalifera* and *Purpurifera*. The *Alata* consist of the genera *Rostellaria, Pterocerus* (or, as Lamarck incorrectly writes it, *Pterocera*), and *Strombus.*

Cuvier arranges *Strombus* next to *Turbinella* and at the end of his *Pectinibranchiate Gastropods*. He defines the genus *Strombus*, Linn., as comprising shells with a canal which is either straight or inflected towards the right, the external border of whose aperture dilates with age, but always preserves a sinus towards the canal, under which the head of the animal passes when it extends itself. The greater part have, he adds, this sinus at some distance from the canal.

Cuvier nearly follows Lamarck in the subdivisions of the genus.

Of the *Strombi*, properly so called, he says, that the external border or lip dilates into a wing, which is more or less extended, but not divided into digits. Their foot is small in proportion, and their tentacles carry their eyes on a lateral pedicle, stouter than the tentacle itself. The *operculum* is horny, long, and narrow, carried on a slender tail.

The *Pterocerata* he characterises as having the external lip divided in the adult into long and slender digitations, varying in number according to the species. The animal is the same as in the *Strombi* properly so called.

The *Rostellariæ*, he remarks, have, in general, a second canal reascending along the spire and formed by the external lip and by a continuation of the columella. In some the lip is still digitated. Their animal resembles that of *Murex*, but carries only a very small operculum (*Strombus Pes Pelecani—Rostellaria Pes Pelecani*, Lam.; *Aporrhais*, Petiv.). Others again have no more than dentilations on the edge of the lip (*Strombus Fusus*); and others have the lip entire (*Hippochrenes*, Montf.).

Mr. Swainson defines the *Strombidæ*, *Wing-Shells*, which, in his arrangement, stand between the *Turbinellidæ* and the *Volutidæ*, thus:—

'Outer lip dilated, or thickened internally, or detached from the preceding whorl by a sinus; operculum small.'

He makes the family consist of the following subfamilies:—

1. *Strombinæ.*

Subfam. Character.—Outer lip considerably dilated, but never toothed; spire rarely longer than the aperture; with a sinus near the base.

Genera:—*Aphorrais*, Da Costa (*Aporrhais*, we suppose,

is meant); *Pteroceras*, Lam.; *Strombus*, Linn.; *Strombidea*, Sw.; *Rostellaria*, Lam.

2. *Coninæ.*

Subfam. Character.—Shell coniform; the spire very short, pyramidical or truncate; outer lip slightly detached above, but without a basal sinus.

Genera:—*Terebellum*, Lam.; *Coronaxis*, Sw. (with the subgenera, *Coronaxis*, Sw.; *Puncticulis?* Sw.; *Tuliparia*, Sw.; *Cylindrella*, Sw.; and *Conilithes*, Sw.); *Conus*, Linn. (with the subgenera *Conus*, Linn.; *Dendroconus*, Sw.; *Textilia*, Sw.; *Theliconus*, Sw.; and *Leptoconus*, Sw.); *Conella*, Sw.; and *Conorbis*, Sw.

3. *Columbellinæ.*

Subfam. Character.—Shell small; outer lip considerably thickened within, where the margin is invariably either toothed or striated; the top gibbous, the margin generally inflexed; inner lip doubly toothed, *i.e.* internally and externally; aperture narrow, generally ringent; operculum minute.

Genera:—*Conidea*, Sw.; *Columbella*, Lam.; *Pusiostoma*, Sw.; *Crassispira*, Sw.; *Nitidella*, Sw.

4. *Pleurotominæ.*

Subfam. Character.—Shell turreted, subfusiform; the base channelled, and often much produced; outer lip never thickened, but detached at the top from the whorl by a slit or sinus.

Genera:—*Brachytoma*, Sw.; *Pleurotoma*, Lam.; *Clavatula*, Sw.; *Clavicantha*, Sw.; *Tomella*, Sw.

5. *Cerithinæ.*

Subfam. Character.—Shell clavate, generally mucronate; the spire very long; the outer lip considerably dilated; the base either truncate or forming a short recurved channel.

Genera:—*Potomis*, Brong.; *Pirena*, Lam.; *Terebralia*, Sw.; *Rhinoclavis*, Sw.; *Cerithium*, Lam.

Mr. J. E. Gray makes the *Strombidæ* (the first family of his section *Ctenobranchiata*, Order 1, *Zoophaga*) include the following genera: *Strombus*, *Terebellum*, *Pteroceras*, *Rostellaria*, and *Seraphys*.

In this article the *Strombidæ* will be confined to the genera and subgenera *Strombus*, *Pteroceras*, and *Rostellaria*.

Strombus.

Generic Character.—*Animal* spiral, slightly compressed, furnished with a *proboscis*, at the extremity of which is the mouth opening longitudinally, and containing a lingual riband furnished with sharp points curved backwards: *tentacles* cylindrical, obtuse, and short: *eyes* carried upon two peduncles, which are cylindrical and stout, longer than the tentacles and placed at their external side; *foot* rather small, but enlarged forwards; *mantle* forming in front a canal, which is generally rather short; orifices of the anus and oviduct behind.

Shell thick, oval, oblong, subinvolved, conical in front and behind; spire moderately elevated; aperture long and narrow, terminated anteriorly by a canal more or less long or removed; right lip dilated, and with a sinus a little behind the canal; columellar or inner lip simple, but sometimes callous.

Operculum horny, long and narrow, with a terminal summit, and composed of elements imbricated, as it were. (Rang.)

M. Rang considers that the variations in the shell lead to the establishment of two subgenera, *Strombus* and *Pteroceras*.

M. de Blainville divides the genus *Strombus* into the following sections:—

α. Species whose external lip becomes much dilated with age, and offers a number of digitations variable in number. (Genus *Pteroceras*, Lam.)

Example, *Strombus Scorpius.*

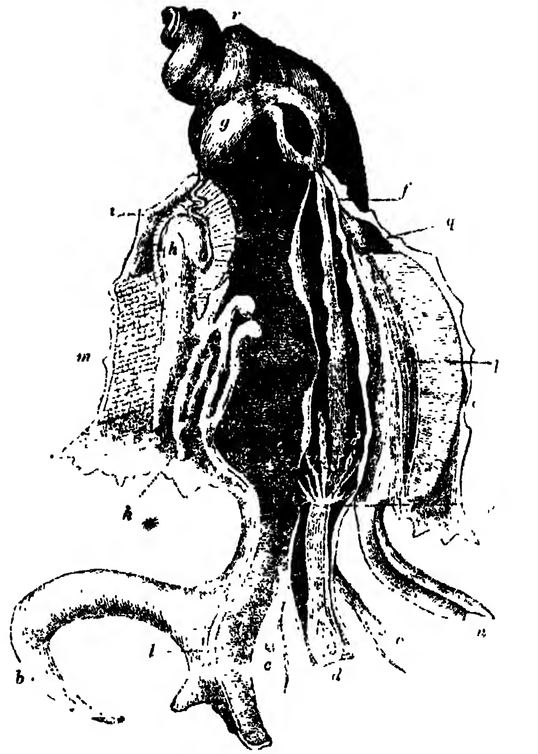
β. Species whose right lip is much dilated, but without digitation.

Example, *Strombus tricornis.*

γ. Species whose external lip is thick, and but little or not at all dilated.

Example, *Strombus Auris Dianæ.*

δ. Species whose right lip is not dilated, and very delicate, which makes them resemble the Cones. (Non-adult Strombi.)



Animal of Strombus lambis; *Pteroceras lambis* of modern authors. (female.)

a, the foot seen in its anterior part with its groove; *b*, the operculum fixed at its posterior division; *c*, *c*, ocular tubes with their tentacles; *d*, the proboscis open to show the tongue; *e*, the cerebral ganglion, behind which are two long salivary glands; *f*, digestive tube entering a large stomach; *g*, the stomach partially opened, and showing the orifice of the œsophagus; *h*, the intestine forming a fold before it forms the very voluminous rectum; *i*, the first part of the uterus; *k*, second part of the uterus, forming meanders before opening into the groove which leads on the right side of the foot; *l*, the groove which does not exist in the males; *m*, follicles of viscosity; *n*, respiratory siphon; *o*, large branchia and its vein which goes to the heart; *p*, small and rudimentary branchia; *q*, the heart; *r*, the liver and the ovary united to the extremity of the tortillon, or turbinated part of the body. (*Voyage of the Astrolabe.*)

Subgenus Strombus.

See the generic character above given for the *animal*.

Shell with a simple wing, and a very short canal, which is truncated or notched.

Operculum.—See the generic character above stated.

The species are extremely numerous, and many of them are gigantic in size, the well-known *Strombus Gigas* of the West Indies for example. Like some others of the turbinated testaceans, the animals of the genus Strombus occasionally produce pearls. Mr. Wood, in his 'Zoography,' relates that he saw a pink pearl which was taken from the body of the animal of *Strombus Gigas*, which is fished for the table off the island of Barbadoes. The pearl was discovered by chance, while the men were employed in cleaning the fish. Its weight was 24 grains, but it would have been more valuable if it had been round. The same author states that only four of these pearls had been discovered in the vast numbers of shell fish that are annually brought to market in that part of the world, though he has reason to believe that this is in some measure owing to the carelessness of the negroes, who clean their fish without consideration, and have probably in their hurry returned many a pearl to its native element with the refuse of the animal. This pearl was exactly of the same colour as the interior coat of the shell, and like it in every respect except in figure.

Geographical Distribution of the Genus, Habits, &c.—The seas of warm climates; many from those of India, and some from those under and near the equator. Carnivorous. Species have been found at depths varying from 0 to 13 fathoms.

M. Deshayes, in his Tables, makes the number of recent *Strombi* forty-five. M. de Blainville reckons them at fifty-two; of these *Strombus Gigas* is noted as found both recent and fossil (tertiary).

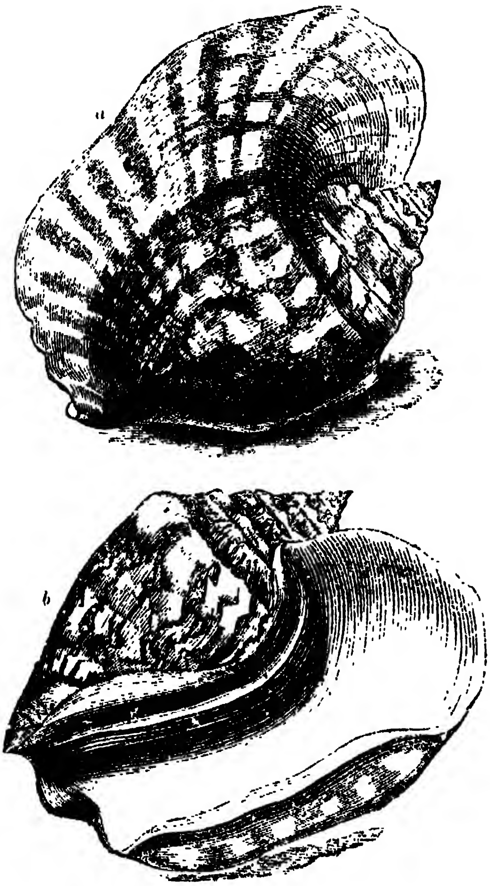
Example, *Strombus latissimus.*

Description.—Shell turbinated, ventricose, smooth on the

back, somewhat wrinkled on the wing, brown orange spotted with white; the spire short and nodulous: the external lip very broad, rounded above, projecting beyond the spire, the anterior margin sharp, but the side of it very thick; the aperture smooth and white, tinged with rose colour.

Locality.—East Indian Seas.

This fine and somewhat rare species grows to a large size, from five to ten or more inches in length.



Strombus latissimus.
a, seen from above; *b*, seen from below

We have selected this species because it is one of those that leads to the next subgenus.

Pteroceras.

Animal.—See the generic character above stated, and the cut and description of the animal, p. 123.

Shell with the wing digitated, and furnished forwards with an elongated canal.

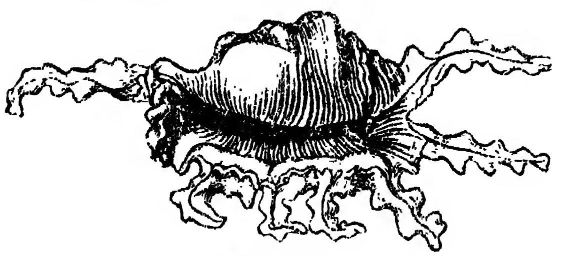
Operculum.—See the generic character above.

Geographical Distribution of the Genus, Habits, &c. The Indian seas. Carnivorous. *Pterocerata* have as yet been only noticed as littoral.

The *Pterocerata* are very much less numerous than the *Strombi*. M. Deshayes, in his Tables, makes their number seven: no fossils.

Example, *Pteroceras Scorpius.*

Description.—*Shell* ovate-oblong, gibbous, tuberculate; transversely rugose and knotty, seven fingered, white



Pteroceras Scorpius.

spotted with rufous, the fingers rather slender, and knotted at intervals throughout their length, the anterior ones and the tail the longest, and curved; aperture violaceous-red wrinkled with white.

Locality.—East Indian Seas.

Rostellaria.

This genus is placed between *Pleurotoma* and *Fusus* among his SIPHONOSTOMATA by M. de Blainville. M. Rang arranges it between *Pleurotoma* and *Strombus*. Cuvier places it under the latter genus.

Generic Character.—*Animal* imperfectly known, but bearing a considerable resemblance to that of *Murex*, according to Cuvier.

Shell fusiform or subturriculate, with an elevated pointed spire; aperture oval, canal projecting, and terminating in a pointed beak; external lip simple, dentated, digitated, or very much dilated, furnished with a sinus near the canal, and having generally a second canal ascending upon part of the spire.

Geographical Distribution of the Genus, Habits, &c.—The Asiatic Seas, if we except *Rostellariæ Pes Pelecani* and *Pes Carbonis* (genus *Aporrhais*), which are found in the Mediterranean and other European seas. A very fine specimen of *Rostellaria rectirostris* was brought up in the mud lying on the fluke of an Indiaman's anchor, in the Straits of Macassar. Carnivorous.

The number of recent species enumerated by M. Deshayes in his Tables is seven recent, and, of these, three, *Rostellariæ Pes Pelecani*, *Pes Carbonis*, and a new species, are noted as being found both living and fossil (tertiary).

M. de Blainville thus divides the genus:—

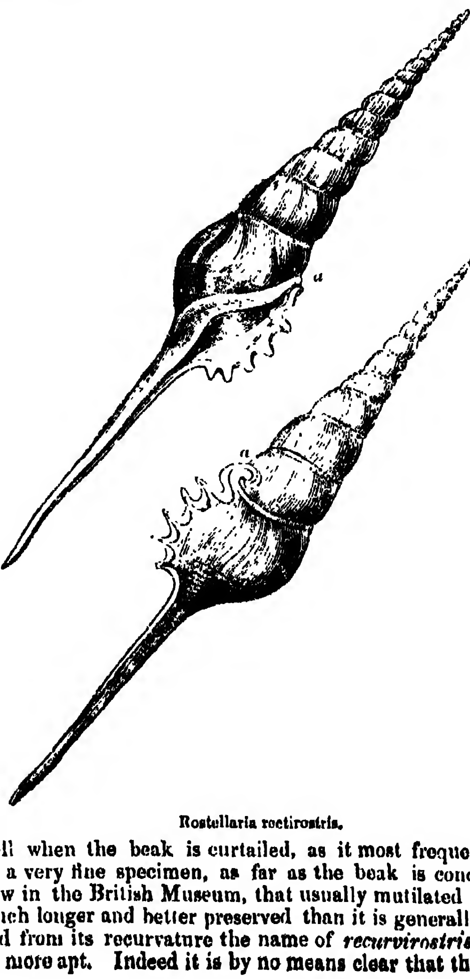
α Species whose external lip is digitated.

Example, *Rostellaria curvirostris.*

β. Species whose external lip is dilated and not dentated.

Example, *Rostellaria Macroptera* (genus *Hippochrenes* of De Montfort—fossil).

Rostellaria curvirostris (*Strombus fusus*, Linn.), the *Spindle* of collectors, is by far the most common of the Asiatic species. We illustrate the genus by *Rostellaria rectirostris*, Lam., a name which suits this rare species



Rostellaria rectirostris.

well when the beak is curtailed, as it most frequently is. In a very fine specimen, as far as the beak is concerned, now in the British Museum, that usually mutilated part is much longer and better preserved than it is generally seen, and from its recurvature the name of *recurvirostris* would be more apt. Indeed it is by no means clear that there are

not two species of this long-beaked kind of *Rostellaria*, one much darker than the other, and not so slender.

Description.—Shell fusiform-turreted, smooth in the middle, squalid white; the whorls rather convex, the last transversely sulcated below, the upper more convex and cancellated; external lip toothed on the margin; beak very long, slender, very straight.

Such is Lamarck's description; but those unfaded specimens which we have seen have been of different hues of brown. The lip terminates above in an elegantly turned canal or volute upon the bottom whorl of the spire, *a a* in the subjoined cut. Some specimens that we have seen have been of a deep brown, approaching to black in the inside of the outer lip. In the young shells the external lip is not dentated. Lamarck gives the length of the adult as 5 inches 10 lines, but the shell above noticed as being in the British Museum, and which has the longest beak we ever saw in the species, is of much greater length. The shell is called by collectors the *Chinese Spindle.*

FOSSIL STROMBIDÆ.

Strombus.

Lamarck records but one fossil species, *Str. Canalis* (Grignon). M. de Blainville remarks that when he wrote (1825) only five species of true *Strombi* had been found fossil, one of which, from the Plaisantin, is an analogue, according to Brocchi.

M. Deshayes, in his Tables, makes the number of fossil *Strombi* (tertiary) nine, *Str. Gigas* being, as already stated, both recent and fossil.

Rostellaria.

Lamarck records the following fossil species:—*Rostellaria macroptera* (*Strombus amplus*, Brand; *Hippochrenes macropterus*, Montf.), from St. Germain-en-Laye; *Rostellaria columbata*, from the same locality, and *Rostellaria fissurella*, from Grignon and Courtagnon.

Defrance notices fifteen fossil species; one identical from the Plaisantin, and an analogue from Grignon.

M Deshayes, in his Tables, records the number of fossil (tertiary) *Rostellariæ* as eight; three species, as above stated, being both recent and fossil.

Mr. Lea (*Contributions to Geology*) describes and names two species, *Rostellaria Lamarckii* and *Cuvieri*, from the Claiborne Beds, Alabama (tertiary).

Dr. Mantell (*Organic Remains of the County of Sussex*) records *Rostellaria Sowerbii* from the arenaceous limestone or sandstone of Bognor; and *Rostellariæ Parkinsoni*, *carinata*, and a species 'with two processes' very closely resembling *R. Pes. Pelecani* (genus *Aporrhais* of some authors), from the Shanklin sand.

Professor Phillips (*Organic Remains of the Yorkshire Coast*) notes *Rostellariæ Parkinsoni* from the Speeton Clay; *composita*, from the Bath and inferior oolite; *bispinosa* from the calc. grit and Kelloways rock; and *trifida* from the Oxford clay.

Professor Sedgwick and Mr. Murchison (*Structure of the Eastern Alps*) record *Rostellariæ costata*, *granulata*, and *lævigata* from the Gosau deposit and its equivalents in the Alps.

Dr. Fitton (*Strata below the Chalk*) gives the following species in his well digested Stratigraphical and Local table: *Rostellariæ buccinoides*, from the gault, Kent; *calcarata* from the gault, Kent, the lower green-sand of Sussex, Isle of Wight, and Norfolk, and from Blackdown; *carinata*, from the gault of Kent, Surrey, and South Wilts; *elongata*, from the gault of Kent; *marginata* from the same locality; *macrostoma* from Blackdown; *Parkinsonii*, from the gault of Kent, the lower green-sand of Sussex and the Isle of Wight, and from Blackdown; *retusa* from Blackdown; *doubtful* from the lower green-sand of Kent; very like *Pes Pelecani* from the lower green-sand of Sussex; and a new species from Blackdown.

STRO'MBOLI. [LIPARI ISLANDS.]

STRÖMHOLM, CANAL OF. [SWEDEN.]

STROMNESS. [ORKNEY ISLANDS.]

STROMNITE. [STRONTIUM.]

STRONSA. [ORKNEY ISLANDS.]

STRÖNSTED. [SWEDEN.]

STRO'NTIUM, a peculiar metal found in combination with oxygen and carbonic or sulphuric acid, and forming the carbonate and sulphate of strontia. From the very considerable resemblance existing between barytes and strontia they were once supposed to be identical. Crawford and Sulze noticed a difference between them, and in the year 1792 Dr. Hope established sufficient differences to prove that they were completely distinct bodies, and the newly discovered body was named *Strontia* or *Strontites*, from Strontian in Scotland, the place in which it was discovered.

Strontium was procured from the carbonate of strontia by Davy in 1808; the method adopted is that which we have described for obtaining barium [BARIUM] from the carbonate of barytes. Its properties have been but imperfectly examined; it has not a very high lustre, is heavier than sulphuric acid, appeared fixed, difficultly fusible, and not volatile. When exposed to the air it attracted oxygen, and became converted into strontia; when thrown into water, it decomposes it with great violence, producing hydrogen gas, and forming with the water a solution of strontia.

Oxygen and Strontium, as just mentioned, readily unite, constituting the *protoxide*, or *strontia*, which exists largely in nature, and the *peroxide*, which is entirely an artificial product. The simplest mode of procuring the protoxide, or strontia, when required to be free from water, is to dissolve the native carbonate in nitric acid, and to decompose the crystallized nitrate obtained at a red heat; or the sulphate of strontia, which is a much more common substance, may be converted by the well known means first into sulphuret and then into nitrate. The properties of strontia are, that it has a greyish-white colour; its specific gravity is between 3 and 4; it is very infusible, not volatile, has an acrid taste, and has an alkaline reaction on vegetable colours. On comparing these properties with those of barytes, it will be observed that there is considerable resemblance between them, but they differ in one remarkable respect, namely, that strontia, unlike barytes, is not poisonous. When exposed to the air it attracts carbonic acid, and is reconverted to the state of carbonate.

Strontia is composed of—

One equivalent of oxygen . .	8
One equivalent of strontium . .	44
Equivalent . . .	52

Strontia and Water combine to form at least two compounds: when a small quantity of water is poured upon strontia, it slacks, gives out heat, is rendered white; and becoming a hydrate, it is fusible at a white heat, but does not part with its water.

It consists of—

One equivalent of water . .	9
One equivalent of strontia . .	52
Equivalent . . .	61

According to Davy, strontia is soluble in about two hundred times its weight of water at common temperatures. The solution is called *Strontia water*, and is occasionally employed as a chemical reagent; it acts energetically as an alkali on vegetable colours and in saturating acids. In boiling water strontia is much more soluble than in cold. As the solution cools, crystals, the primary form of which is a right square prism, are deposited, and these appear to consist of—

Ten equivalents of water . .	90
One equivalent of strontia . .	52
Equivalent . . .	142

Peroxide of Strontium may probably be obtained, as the peroxide of barium is, by passing oxygen gas over strontia at a red heat, or by heating it with chlorate of potash. It appears to contain two equivalents of oxygen to one of strontia, but is not an important compound.

Neither azote nor hydrogen unites with strontium.

Chlorine and Strontium combine to form only one compound, consisting of—

One equivalent of chlorine . .	36
One equivalent of strontium . .	44
Equivalent . . .	80

The best mode of procuring this salt is to dissolve carbonate of strontia in dilute hydrochloric acid, and to evaporate the solution to its crystallizing point, the chloride containing water then separates in long slender crystals, which consist of 1 equivalent of chloride 80 + 1 equivalent of water 9. When exposed to heat the water is expelled, and a solid white chloride remains. The crystals deliquesce in a moist atmosphere, are soluble in twice their weight of

water at 60°, and still more so in boiling water; this salt is soluble also in alcohol, and the solution when burning exhibits the peculiar red flame characteristic of the compounds of this base.

Chloride of strontium may be more directly, but less eligibly, prepared than in the mode now described, by passing chlorine gas over heated strontia; oxygen gas is expelled, and chloride of strontium remains.

Fluoride of Strontium is an insoluble pulverulent compound.

Sulphuret of Strontium may be formed either by heating the native sulphate with charcoal, or by fusing strontia and sulphur in a green glass tube. It dissolves in hot water, and as the solution cools crystals of sulphuret of strontium are formed. They appear to contain water, independently of which they are probably composed of—

One equivalent of sulphur	16
One equivalent of strontium	44
Equivalent	60

This compound is used for the preparation of the salts of strontia, the sulphate being a much more common substance than the carbonate, which is preferable however when obtainable.

We shall now describe three oxisalts of strontia, two of which exist in nature, and the third is occasionally employed in chemical researches.

Carbonate of Strontia: Strontianite.—This was the first discovered compound of strontia; it occurs crystallized and massive. Primary form a right rhombic prism. Cleavage parallel to the lateral faces of the primary form. Fracture uneven. Hardness, scratches carbonate of lime, but is scratched by fluor-spar. Colour white, greenish, greyish, and brown. Streak white. Lustre vitreous. Transparent, translucent. Specific gravity 3·605.

Before the blow-pipe it fuses, and gives a purple light. Dissolves with effervescence in dilute nitric acid, and the solution is precipitated by sulphuric acid.

Massive Varieties.—Amorphous, globular. Structure fibrous, sometimes granular.

Found at Strontian in Scotland, Braunsdorf in Saxony, and in Peru.

Analysis by Klaproth:—

Carbonic acid	30·
Strontia	69·5
Water	0·5
	100·

Stromnite, or *Barystrontianite*, or *Barytiferous Carbonate of Strontia*, is a mineral found at Stromness in Orkney. It occurs massive. Structure fibrous. Hardness 3·5. Specific gravity 3·7. Lustre somewhat pearly. Translucent on the edges. Colour greyish and yellowish white. It is soft and brittle. Effervesces with acids, but does not melt before the blow-pipe.

According to Dr. Traill, who discovered this substance, it consists of—

Carbonate of strontia	68·6
Sulphate of barytes	27·5
Carbonate of lime	2·6
Oxide of iron	0·1
Loss	1·2
	100·

Carbonate of Strontia may be artificially obtained by several processes; as by exposing strontia water to the air, or by adding an alkaline carbonate to it; or by decomposing any soluble salt of strontia, by means of an alkaline carbonate, &c. In whatever mode obtained, it is a colourless insipid powder, quite insoluble in water, decomposed by acids with effervescence, and by exposure to a high temperature. It is used for preparing the various salts of strontia, and is composed of—

One equivalent of carbonic acid	22
One equivalent of strontia	52
Equivalent	74

Sulphate of Strontia: Celestin.—Exists largely in nature. It occurs crystallized and massive. Primary form a right rhombic prism. Cleavage easy, parallel to the base of the primary form, but less so in the direction of the lateral faces. Fracture conchoidal, uneven. Scratches carbonate of lime, but it is scratched by fluor-spar. It is brittle. Colour white, bluish, reddish-white. Transparent; translucent. Lustre vitreous. Specific gravity 3·858.

The *Massive Varieties* are nodular, tabular, and amorphous. Structure columnar, fibrous, granular.

It is not acted upon by acids. Before the blow-pipe it decrepitates and fuses into a white friable enamel. The powder becomes phosphorescent on a hot iron.

According to Klaproth it consists of—

Sulphuric acid	42
Strontia	58
	100

This substance occurs near Bristol, in Sicily, at Bex in Switzerland, &c.

Sulphate of Strontia and Barytes: Grunerite.—This mineral is found in Hanover. It occurs massive. Its structure is radiated. Hardness 3·0 to 3·5. Colour white, with sometimes a shade of blue. Translucent. Lustre vitreous. Specific gravity 3·76.

Sulphate of Strontia may be obtained artificially, by adding sulphuric acid, or a sulphate, to any soluble salt of strontia. It is a colourless, insipid, heavy powder, insoluble in water, and dissolved only by strong sulphuric acid, from which it is precipitated by water. It is composed of—

One equivalent of sulphuric acid	40
One equivalent of strontia	52
Equivalent	92

Nitrate of Strontia is procured by dissolving the carbonate in dilute nitric acid, or by decomposing the sulphuret of strontium with it. The solution is colourless, and by evaporation yields crystals, which are composed of—

One equivalent of nitric acid	54
One equivalent of strontia	52
Equivalent	106

It crystallizes in octohedrons, is soluble in five parts of water at 60°, and in half a part at 212°. It is insoluble in alcohol, but when finely powdered and mixed with it, the alcohol burns with a beautiful red flame.

Under peculiar circumstances a hydrate nitrate of strontia is formed, containing four equivalents of water. The form of this is an oblique rhombic prism.

The salts of strontia are occasionally used in chemical investigations, and in giving a purple flame to fire-works.

STROPHE (στροφή) is a set of verses composed according to a certain system of metres. The word is derived from στρέφω, 'to turn,' as in the lyric, especially the choral poetry of the Greeks, this part of a poem was sung during the movements and dances of the chorus. In modern times such a combination of verses, written either in the same or in different metres, is commonly designated by the Italian name stanza. The division of a poem into strophes was however applied by the antients only to lyric poetry, and here one strophe seldom exceeded the number of four verses, with the exception of the dramatic and other choruses, in which a strophe sometimes contains a considerable number of verses. However different the metre of the several verses may be, there is always a unity of rhythm in them which characterises a strophe as an artistic whole. The various kinds of strophes were designated by the antients by various names which either indicated the number of verses they contained, such as disticha, tristicha, tetrasticha, &c., or were derived from the name of their inventors, or from the characteristic metre in which they were composed, such as the Alcaic, Sapphic, Choriambic strophe, &c. Again, strophes in which all the verses are of the same metre are called monocola, and those consisting of verses of two, three, or four different metres, are called dicola, tricola, or tetracola. The choral poems of the Greeks generally consisted of three main parts, strophe, antistrophe, and epode. The antistrophe always corresponds in its metre with the strophe, and thus forms a second stanza, equal to the first; the epode differs from both, and forms the concluding stanza of a chorus. (G. Hermann, *Elementa Doctr. Metr.*, p. 433, ed. Glasgow.)

STROPHO'MENA, M. Rafinesque's name for the brachiopodous fossil shell described by Dalman under the name of *Orthis*. [BRACHIOPODA, vol. v., p. 313.]

STROPHO'STOMA, the name given by M. Deshayes to a fossil shell somewhat resembling *Anostoma*, with the aperture reflected towards the spire. [HELICIDÆ, vol. xii., p. 110.]

STRO'PHULUS is an eruption of pimples upon the skin, which frequently occurs in infants whose health is disordered by the irritation of teething or any other cause. Dr. Willan describes the following forms of the disease:—

1. S. intertinctus, of which the vulgar name is red-gum or red-gown. The eruption in this form consists of vivid-red distinct papulæ, scattered in varying numbers over the cheeks, the arms, the backs of the hands, or, in some cases, the whole body. After an uncertain duration the papulæ disappear, the cuticle separating in scurf; but very frequently the fading of one eruption is rapidly followed by the appearance of another, which passes through similar stages, and generally spreads further over the skin. A few of the papulæ in each eruption sometimes assume the character of small pustules, a little fluid being formed in their apices: but this commonly disappears without bursting. The origin of the eruption may usually be traced to disorder of the digestive organs, by a gentle correction of which it may be cured. A sudden repulsion of it by exposure to the cold, or any injudicious remedies, may bring on diarrhœa, and even severe general illness. In itself it is a disease of no importance.

2. S. albidus differs from the preceding only in the colour of the papulæ, which consist of minute whitish specks, slightly elevated, and usually surrounded by a pale ring of red. They appear in the same situations as those of the first variety, are referrible to a similar origin, and require no other treatment.

3. S. confertus is often called the tooth-rash, and the rank red-gum. It occurs only during the process of teething, and consists (in children of three or four months old) of small closely-set papulæ, less vivid but more permanent than those in S. intertinctus. Their usual seat is on the cheeks and sides of the nose; sometimes they extend to the forehead and the arms, and sometimes large papulæ appear upon the loins. If the eruption occurs when the infant is eight or nine months old, it generally assumes a severer form: one or two extensive patches appear on the arms, shoulder, or neck, the papulæ in each being hard, large, and set so closely, that the whole surface of the skin seems bright red. These usually continue for a fortnight, spreading slowly from one part to another, and then fade, leaving the part, after the exfoliation of the cuticle, rough and discoloured for a week or two longer. A similar, but more obstinate and painful form of eruption, sometimes appears on the lower extremities and the lower part of the trunk. It is never advisable however to adopt any active treatment for the remedy of this variety of the disease. It commonly continues during the whole of the early period of dentition; but it affords in some measure a safeguard against more serious disorders, and disappears soon after the first teeth have cut through the gums.

4. The S. volaticus is characterised by small circular clusters of from six to twelve bright-red papulæ, which break out successively in many different parts of the body, remaining in each for about four days, and then becoming brown and disappearing with scurf. The complaint generally lasts three or four weeks, and passes in successive eruptions over a considerable part of the body. It is attended by slight fever and general disturbance of the system, and is most common in children of from three to six months old.

5. S. candidus is distinguished by the papulæ being larger than in any other variety. Their surfaces are smooth and shining, and, their bases not being inflamed, they seem paler than the adjoining skin: they usually last for about a week, and disappear in the same manner as those in the preceding forms. An eruption of this kind is most common in children a year old, who have shortly before its appearance suffered from some acute disease. It requires no active treatment: like all the other varieties of the disorder, it ceases with the irritation from which it has its origin.

STROUD, a parliamentary borough in Gloucestershire. It includes an extensive district, comprehending the parishes of Stroud, Bisley, Painswick, Pitchcomb, Randwick, Stonehouse, Leonard Stanley (excepting a detached portion called Lorridge's farm), King's Stanley, Rodborough, Minchinhampton, Woodchester, Avening, and Horsley; and extending into the four hundreds of Bisley, Dudstone and King's Barton, Longtrees, and Whitstone; its greatest length is about 10 miles from north to south, and nearly the same distance from east and west; its area and population, according to the returns of 1831, were as follows:—

	Area.	Houses.			Population.	
Bisley Hundred.	Acres.	Inhab.	Uninhab.	Building.	Families.	Persons
Stroud .	3990	1746	165	33	1859	8607
Bisley .	7980	1264	116	3	1264	[illegible]
Painswick	6510	837	118	..	886	4099
Dudstone and King's Barton Hundred.						
Pitchcomb	500	43	4	..	43	224
Longtrees Hundred.						
Avening	4660	500	45	3	507	2396
Minchinhampton	4880	1116	153	..	1131	5114
Rodborough	1390	431	67	1	436	2141
Woodchester . .	1180	187	23	1	189	885
Horsley .	4480	799	125	13	836	3690
Whitstone Hundred.						
King's Stanley . .	1740	464	55	2	514	2138
Leonard Stanley	910	184	12	..	184	942
Stonehouse	2260	516	17	8	551	2169
Randwick	1260	203	29	..	215	1031
Total .	41,740	8290	929	64	8618	39,932

From this is to be taken the detached portion of the parish of Leonard Stanley, which is excluded from the borough, but is not distinguished from the rest of the parish in the Population Returns. It has an area of about 300 acres. In the Report of the Parliamentary Boundary Commissioners, it was proposed to include the parish of Eastington, but the Boundary Act did not include it. It adjoins the eastern extremity of the borough.

The borough of Stroud comprehends an important part of the west of England clothing district, drained by the branches of the Stroudwater, which joins the Severn between Gloucester and Berkeley; 'the peculiar features of the district are, the situation of the mills on streams in deep ravines; the scattered and irregular manner in which the houses are built on the hill sides; and the contrast between the high land (in many cases either wood or common, with few inhabitants) and the valleys studded with houses and thickly peopled.' (*Boundary Commissioners' Report.*) It comprehends the market-towns of Stroud, Minchinhampton, and Painswick. Stroud, which gives name to the borough, is 111 miles west by north of the General Post-office, London, viz. 81 miles by the Great Western Railway to Swindon, 18 miles by branch to Cirencester, and 12 miles from Cirencester to Stroud by coach road; the distance by the coach road through Maidenhead, Henley, Abingdon, Faringdon, Lechlade, and Cirencester is 105 miles. Stroud is 9½ miles south of Gloucester. Minchinhampton is 4 miles south-east of Stroud; and Painswick about the same distance north, on the road to Gloucester.

Stroud stands in a picturesque valley at the junction of two of the streams which form the Stroudwater (sometimes called the Frome), a stream celebrated as possessing superior excellence for the dyeing of scarlet cloth. This quality led to this district being early chosen by clothiers and dyers. The town has been greatly improved in modern times; the streets are paved, and contain many good houses. The church is a large building of various dates; it consists of a nave, chancel, and side aisles, with a tower and spire at the western end. A new church has lately been erected in the parish capable of accommodating 1000 persons; and there are places of worship for Baptists, Independents, and Wesleyan Methodists. The market, which is on Friday, is well supplied, and there are two yearly cattle-fairs. It is one of the polling-places for the eastern division of the county. Petty-sessions for the division are held here. The living of Stroud is a perpetual curacy, of the clear yearly value of 132*l.*

Minchinhampton and Painswick, as well as the village of Bisley, are described elsewhere. [GLOUCESTERSHIRE.]

Rodborough is a village one mile south-west of Stroud. The church, formerly a chapel to Minchinhampton, 'has a tower with pinnacles; and a nave, chancel, and south transept: amidst many alterations, some antient features remain. (Rickman.) The Independents have a place of worship. Nailsworth is a chapelry, partly in Avening and partly in Horsley parish. The village of Nailsworth is about

two miles south-west of Minchinhampton, and extends into Minchinhampton parish. It has several dissenting meeting-houses. A customary market is held on Saturday. Horsley is about two miles south-south-west of Nailsworth, and six south of Stroud. It has a church and two dissenting meeting-houses, a national school, and a small house of correction. Petty-sessions for the district of Longtree are held in turn at Horsley, Rodborough, and Tetbury, the last being out of the borough. King's Stanley, three miles south-west of Stroud, has some antiquities, as the remains of a Roman camp, and of a residence of the Mercian kings. Several Roman altars and other antiquities were dug up about two miles from the camp. Leonard (or St. Leonard) Stanley, four miles west-south-west of Stroud, has some remains of a priory of Benedictines, dedicated to St. Leonard. The conventual church, now parochial, is partly of early English architecture. The convent kitchen is used as a dairy. Leonard Stanley was formerly a market-town; it is now a scattered and irregular village, but has a considerable share in the clothing manufacture. Stonehouse, four miles west of Stroud, has an antient church which retains many of its antient features, though much modernised: the north door is Norman. Woodchester, two miles south-west of Stroud, was probably a Roman station. Interesting remains of a Roman villa have been discovered here, especially a large tessellated pavement, 48 feet 10 inches square, very richly and elaborately ornamented, and far superior to anything of the kind discovered in Great Britain.

The number of persons engaged in manufactures, almost entirely of woollen cloth, in 1831, was 2539. The Stroud canal, or Stroudwater navigation, passes through the borough. It commences in the Severn near Framiload, between Gloucester and Berkeley, and runs eastward eight miles to Wallbridge, near Stroud, where it joins the Thames and Severn Canal, which runs by Stroud, 30 miles eastward to the Thames at Lechlade. The Stroudwater navigation was formed under acts passed between 1730 and 1776; the Thames and Severn Canal under acts passed from 1783 to 1813.

All the parishes in the borough are in the archdeaconry of Gloucester and diocese of Gloucester and Bristol; and all, we believe, except Pitchcomb, in the rural deanery of Stonehouse: Pitchcomb is in the deanery of Gloucester.

The parishes comprehended in the borough (including the detached part of Leonard Stanley, which we have no means of distinguishing) had, in 1833, eighty-seven day-schools of all kinds, with 3245 scholars, viz. 1304 boys, 970 girls, and 971 children of sex not distinguished: six of these day-schools were also Sunday-schools, and were attended on Sunday by 480 children. There were forty-four Sunday-schools, beside the six just mentioned, with 6132 scholars of both sexes.

The borough returns two members to parliament: the number of electors on the register in 1835-6 was 1295; in 1839-40 it was 1202. (*Parliamentary Papers.*)

STROUD. [ROCHESTER.]

STROZZI, an historical family of Florence, of the period of the republic, which produced many distinguished men both in learning and politics. The Strozzi are mentioned in the beginning of the fourteenth century by the chronicler Dino Compagni as belonging to the Guelph and Neri party, of which they became one of the leading families. After the revolt of the lower orders, in 1378, was suppressed, Tommaso Strozzi joined Salvestro de' Medici, Benedetto Alberti, and Giorgio Scali, in supporting the popular government against the burgher aristocracy, at the head of which were the Albizzi and some of the Strozzi themselves, who, on suspicion of a conspiracy against the existing government, were seized in 1379, and summarily put to death. A fresh insurrection, in 1381, upset both Tommaso Strozzi and Giorgio Scali: Strozzi escaped, but Scali was beheaded. Tommaso Strozzi retired to Mantua, whither a branch of the Strozzi was thus transplanted.

In the following century the most conspicuous of the family was Palla Strozzi, who filled several high offices: he was at the siege and surrender of Pisa in 1406. He was afterwards employed on several missions: he was sent, together with Cosmo de' Medici, to the congress of Ferrara in 1432, when peace was concluded between the duke of Milan on one side, and Florence and Venice on the other, through the mediation of duke Nicholas of Este. Shortly after this a civil strife broke out between the rival families of the Medici and the Albizzi, and Palla Strozzi joined the party of the latter. The Medici, from the time of Giovanni, father of Cosmo, had taken the popular side, especially in the business of the catasto or census, by which taxation upon property was fixed in proportion to the value of each citizen's property. This measure had been strenuously opposed by the grandi, or older wealthy families, who, having had hitherto the government in their hands, had never paid their proper share of the public burthens, which fell chiefly on the inferior citizens. The Albizzi, who were at the head of this burgher aristocracy, became jealous of the popularity of the Medici. In 1434 they contrived by means of money to have the Gonfaloniere, and the majority of the signori or executive, elected from among their friends. Cosmo de' Medici was then sent for to the town palace by the new Gonfaloniere, and put in prison. He was charged with sundry misdeeds; among others, with having, together with his friends, by their machinations and intrigues, 'caused the republic to undertake an impolitic war against Lucca, which had nearly proved the ruin of the state.' (Fabbroni, *Vita Cosimi Medicei.*) A parliament, or general assembly of the people, was assembled in the square, surrounded by armed men of the Albizzi party: the parliament appointed a balia, or dictatorial commission, which found Cosmo guilty of the various charges brought against him, and sentenced him to banishment, together with his brother Lorenzo and several of his friends. This was the summary mode of settling state matters in the Florentine republic. Rinaldo degli Albizzi, who had himself countenanced the war against Lucca, was most inveterate against Cosmo, and proposed to put him to death; but the more moderate of his party, and Palla Strozzi among others, thought banishment was enough. After a twelvemonth, a reaction took place in favour of the Medici: an executive was chosen from among their friends. Rinaldo degli Albizzi now proposed to his friends to resort to arms to prevent the new executive from taking their seats of office, and to oblige the signoria that was going out to appoint a balia which would appoint an executive favourable to them. Palla Strozzi, too honest or too weak for a partizan, opposed the proposal of Rinaldo as too violent and illegal, and advised to wait and watch the acts of the new executive. This was the ruin of the Albizzi; for the new governors began by imprisoning the late Gonfaloniere, and he summoned the Albizzi to appear at the town palace. Upon this Rinaldo summoned his friends to arms; but many of them declined to obey his call; and Palla Strozzi, after several messages, came out with two armed followers; at which Rinaldo broke out in bitter words of reproach, and Strozzi, after a brief retort, turned his horse's head and went home. Rinaldo remained in uncertainty; he parleyed with his enemies; whilst the signoria had time to send for troops from the country, which occupied all the strong posts in the city. The usual parliament was then assembled, and a balia was appointed, which condemned the Albizzi, Strozzi, and many others to exile, A.D. 1435. Palla Strozzi went to Padua, where he spent the remainder of his life in studious retirement. He died at Padua in 1462, at ninety years of age. 'On arriving at Padua, he devoted himself entirely to study, and found in it a harbour from past storms. He took into his house John Argyropulos and another learned Greek, and allowed them a good salary to read to him Greek works. Argyropulos read to him Aristotle on natural philosophy, and the other read to him other works. Palla Strozzi was himself well acquainted with Greek, and he translated into Latin the works of John Chrysostomus.' (Tito Vespasiano Strozzi, in Méhus's *Life of Ambrosius Traversari.*)

Before his exile, Palla Strozzi had exerted himself to encourage learning in his native city of Florence. Together with Coluccio Salutati and Niccolo Nicoli, he engaged Manuel Chrysoloras to come from Greece to Italy, about 1396; and Strozzi defrayed in great part his expenses, and caused him to be retained at Florence as professor of Greek. Books however were still wanted; and Strozzi sent to Greece for them, and obtained many volumes at his own expense. Among other books, he got the 'Politics' of Aristotle, the 'Cosmography' of Ptolemy, with the maps, the 'Lives' of Plutarch, and the works of Plato. About the year 1428 Palla Strozzi was chosen, with Giannotti Mannetti, to reform the University of Florence, and they established new chairs, and gave a fresh vigour to that institution. It was by Palla Strozzi's advice that Filelfo was engaged as professor with the stipend of 300 crowns, and the new professor soon after had nearly 400 pupils. Strozzi was about to form a public library at Santa Trinita, in the centre of Florence; he

had purchased many books, and had engaged amanuenses to transcribe others for the purpose, when the unfortunate civil factions of 1434-5, and his own exile, prevented the execution of his plan. But yet Palla Strozzi, with Salutati, Manetti, and others, must be considered as having greatly contributed to the revival of classical studies in Italy, before the brilliant æra of the Medici, to whom the whole merit has been commonly attributed. Thomaso Sarzana, afterwards Pope Nicholas V., of illustrious memory, was for a time a guest of Palla Strozzi at Florence, and improved himself in his society. Filelfo was a great friend of Palla, and the friendship was permanent. Timoteo Maffei of Verona, Paolo Cortese, Ercole Strozzi, and others, wrote eulogies of Palla Strozzi.

A collateral branch of the Strozzi lived at Ferrara in the 15th century. Its progenitor was Nanni or Giovanni Strozzi, a Florentine, who removed to Ferrara, and became a distinguished captain in the service of the Marquis Nicholas of Este, was ennobled, and acquired considerable wealth. Nanni left four sons, all of whom applied to literature; but the most distinguished of them was Tito Vespasiano Strozzi, who studied under Guarino da Verona, and became a distinguished scholar and Latin poet. Some of his 'Carmina' were published by Aldus Manutius, and they contain his own biography; others are still inedited. Tito Vespasiano filled several judicial and administrative offices at Ferrara. He was appointed by the duke president of the Council of the Elders, and was sent ambassador to Rome in 1484. As an administrator however it appears from some contemporary chroniclers that he was very unpopular. (*Diario Ferrarese*, in Muratori, *Rer. Ital. Script.*, xxiv.) He died about 1508, and his tomb is in the church of Santa Maria del Vado at Ferrara.

Ercole Strozzi, son of Tito Vespasiano, rivalled and perhaps surpassed his father as a poet. He wrote both Latin and Italian: some of his Latin verses are published together with those of his father. He began a poem in praise of Duke Borso of Este, which he left unfinished. He was a friend of Bembo, Giovio, and other illustrious contemporaries, and Ariosto (*Furioso*, c. 42) has placed him among the excellent poets of his age. The mode of his death was tragical. He had just married Barbara Torella, of a noble family of Ferrara, when, on the 6th of June, 1508, he was murdered one evening as he was returning home, and his body was found on the road with twenty-two stabs, and wrapped up in his mantle. Giovio says that a personage of high rank, whom he does not name, was through jealousy the author of the murder. The Duke Alfonso of Ferrara was suspected. Some of the Latin elegies of Ercole Strozzi resemble those of Ovid in ease and pathos, and in one of them he seems to foretel his own death. He was buried in the same church as his father. His widow, who was also a poet, wrote a sonnet on his death, which is in the 'Raccolta dei Poeti Ferraresi.'

Of the main stock of the Strozzi family which remained at Florence, the most celebrated was Filippo Strozzi, who figured at the period of the fall of the republic. Filippo acted an ambiguous part; he was ambitious, and had great influence through his connections and his great wealth, being possessed of large funds in various banking-houses in several countries of Europe. He was at times the friend and at others the rival of the Medici. He married Clarice, daughter of Piero de' Medici and niece of Leo X., a haughty ambitious woman, who ill brooked to see two illegitimate scions of the family, Alessandro and Cardinal Ippolito, placed by Pope Clement VII. to rule over Florence. Filippo and his wife were the instigators of the popular movement of May, 1527, in which the republic was restored and the two young Medici were reduced to a private condition. Filippo Strozzi was a supporter of the new gonfaloniere Capponi and of the moderate party, in opposition to the violent men who wished to proscribe all the friends of the Medici, and drive matters to extremities. In 1529, by the treaty of Barcelona, between Charles V. and Pope Clement, it was agreed to make Alessandro, the spurious and even dubious son of Lorenzo, duke of Urbino, son of Piero, duke of the Florentine state, and Charles V. agreed to give him in marriage his natural daughter Margaret. An army of mixed Imperial and Papal troops was sent against Florence, which was obliged to surrender, after an obstinate resistance, in which several members of the Strozzi family distinguished themselves, in August, 1530, and Lorenzo Strozzi, brother of Filippo, was one of the commissioners who signed the capitulation on the part of the Florentines. Filippo, who was then at Rome, took part in the various conferences held there by the friends of the Medici in the presence of Pope Clement, concerning the sovereignty to be given to Alessandro. Filippo Strozzi returned to Florence and appeared to be on good terms with the new duke, to whom he even lent money to build a citadel to overawe the city. But Strozzi and his family were too wealthy and too ambitious to be long subservient to a young upstart whose character was despicable. The sons of Filippo were fiery and restive, and his daughter Luisa, who had married Luigi Capponi, having been publicly insulted by one of the duke's courtiers, the latter was assailed one evening and roughly handled by some unknown men. Her brothers, being suspected, were arrested, but afterwards liberated by an order from Pope Clement. The unfortunate Luisa died soon after of poison. Filippo and his sons left Florence for Rome, where Paul III., Clement's successor, felt not the same interest as his predecessor for the Duke of Florence. Cardinal Ippolito de' Medici, an illegitimate son of Giuliano, duke of Némours, being piqued at having been set aside for his cousin Alessandro, encouraged the Florentine malcontents, who assembled at Rome under his auspices, and among whom Filippo Strozzi and his sons were conspicuous. Cardinal Ippolito however died suddenly, not without suspicion of poison. In the year 1535, when Charles V. landed at Naples on his return from the Tunis expedition, Filippo Strozzi and other Florentine emigrants appeared before him and complained of the tyrannical and dissolute conduct of Duke Alessandro, who repaired to Naples with his counsellor Guicciardini, in order to answer their charges. Filippo Strozzi offered large sums of money to the courtiers of Charles, to obtain the removal of Duke Alessandro. At last the emperor decided that the duke should remain, but should give a complete amnesty to the political emigrants, who however resolutely refused the boon, and dispersed themselves among various towns of Italy. Filippo Strozzi repaired to Venice.

In 1537 Duke Alessandro was murdered by his relative Lorenzino de' Medici, who was a descendant of Lorenzo, the brother of Cosmo the elder; upon which the partisans of the Medici contrived to have young Cosmo, another descendant of the same branch, elected prince of Florence, with the approbation of Charles V. The Florentine emigrants were now reduced to despair, and being excited by the agents of France and of Pope Paul III., they resolved to try once more the chance of arms. Filippo Strozzi repaired to Bologna, with his son Piero, a young man of rash courage, who had served in the French armies, and with Baccio Valori, Anton Francesco degli Albizzi, Prior Salviati, and others; from thence they made an irruption into the Florentine territory with about 4000 French and Italian mercenaries. The attempt was badly conducted, and a party of the invaders who had taken possession of the castle of Montemurlo, situated between Prato and Pistoja, allowed themselves to be surprised by the soldiers of Cosmo joined by Spanish troops in the emperor's service, and were totally routed. Piero Strozzi was lucky enough to escape, but Filippo and the other leaders were taken and carried to Florence, where most of them were immediately beheaded. Filippo Strozzi was imprisoned in the very fortress which his money had helped to raise. He was there kept as a prisoner of the emperor, under the care of his lieutenant Don Juan de Luna. Charles V., although he hated Filippo Strozzi and all his family as enemies and partisans of France, still hesitated concerning his doom, as Pope Paul and other great personages interceded for him; Duke Cosmo however was eager for his death. The emperor told the pope that he would spare him if he could show that he was innocent of the murder of Duke Alessandro. Filippo Strozzi was at Venice when the murder was committed at Florence, and it appears certain that he had no previous understanding with Lorenzino: he was astonished and for a time incredulous when the latter told him what he had done, but when he was convinced of the truth, he praised Lorenzino for his deed, and extolled him as another Brutus. However Filippo Strozzi was examined, and put to the torture in presence of Cosmo's chancellor and of Don Juan de Luna; but although he suffered cruelly, being of a weak and sensitive frame, he denied all participation in the murder, and Don Juan de Luna at last ordered the torture to cease. Duke Cosmo however seized upon Giuliano Gondi, an intimate friend of Filippo, who, being under the torture, said that he had heard from Filippo that he was privy to the murder. The

depositions were sent to the emperor, who ordered Don Juan de Luna to deliver his prisoner into the hands of Cosmo. Filippo, being informed of this, preferred killing himself to being put to death by the executioner. He wrote a declaration of his motives, inscribed 'Deo Liberatori,' in which he said that after having been already cruelly tortured, and in order to avoid being induced, through the violence of renewed torments, to accuse some of his innocent relations and friends, as had lately been the case with the unfortunate Giuliano Gondi, he had determined to put an end to his existence, and that he recommended his soul to God, begging of his mercy to give him at least a place with Cato of Utica and other virtuous men who had died in a like manner. He then requested his sons to fulfil his testament, and to repay Don Juan de Luna, the Spanish commander of the fortress, for the many accommodations he had granted him, and to bury his body in Santa Maria Novella by the side of his wife, if it should be permitted; otherwise it might lie wherever they would put it. And lastly, addressing the emperor, he entreated him to inform himself better concerning the condition of poor Florence, and to provide better than he had hitherto done for its weal, unless he intended to ruin the city altogether. He signed this remarkable paper, which was found in his bosom after his death, 'Philippus Strozzi jamjam moriturus,' and added as an epigraph the line from Virgil—

'Exoriare aliquis nostris ex ossibus ultor.'

He then seized a sword which had been left, perhaps by a friendly hand, in his prison, and cut his throat. His end excited a feeling of compassion, mixed with horror, all over Italy. Whatever judgment we may form of the character of Filippo Strozzi, in which ambition and weakness were predominant ingredients, we cannot help compassionating him in his death. The mode of his trial was barbarous and illegal: if he had been tried and executed, like his companions, as a rebel or disturber of the public peace caught with arms in his hands, the sentence would have been plausible, but he was kept in prison for a twelvemonth, and then tried for a deed of which he was innocent. Strozzi was generous and accomplished, was well acquainted with classical literature, and he translated Polybius's treatise 'On the mode of forming Encampments,' and also some apophthegms of Plutarch. Many have mistaken him for a real patriot, which he was not; and Charles V. had well judged him, as well as the other leaders of the Florentine emigrants, when he said to Antonio Doria, who was pleading their cause at Naples in the time of duke Alessandro, 'You little understand these men, Antonio; they do not wish the liberty of their country, but their own greatness; for if we were to remove the duke, they would become themselves lords of Florence, in spite of the other citizens, who really love the liberty of their city, but who could not resist the influence and wealth and power of these ambitious leaders.' (Varchi; Segni; Adriani; the *Life of Filippo*, by his brother Lorenzo Strozzi; and Botta, *Storia d'Italia*.) A curious MS. was discovered not many years since in the possession of the cavalier G. F. Uguccioni of Florence, which is an unedited history by Gian Girolamo de Rossi, a friend of Filippo Strozzi, which contains several particulars concerning his untimely end. (*Antologia di Firenze*, No. 127, July, 1831.) The author says that Cardinal Cibo and Cosmo's mother were the great instigators of Filippo's death, because they thought that his great wealth was dangerous in his hands, but would be less so when divided among his children. Filippo had still at his death 50,000 scudi, or crowns, of income, chiefly in the banks of France, which his enemies could not touch, after the emperor had confiscated the funds which he possessed in Spain, Germany, and Italy.

Piero Strozzi, son of Filippo, after escaping from Tuscany, returned to France, where he was patronised by Henry II. and his consort Catherine de' Medici, and rose to high rank in the French army.

In 1553 he was sent, with the title of 'Lieutenant of the King in Italy,' to Siena, which republic was then at war with Cosmo, duke of Florence, and where there was already a French auxiliary force, joined by a number of Florentine emigrants. His brother Leone Strozzi went also with a French naval force to the coast of Piombino, but was killed while attacking a small fortress near the shore. Piero Strozzi mismanaged the defence of Siena; his great object being to attack Florence, he neglected the main matter, which was to defend Siena; he made useless incursions into the Florentine territory. Being defeated, after a desperate fight near Marciano, by the marquis of Marignano, he retired to Montalcino; and the city of Siena, after sustaining the horrors of famine was obliged to surrender to duke Cosmo, in April, 1555. Piero Strozzi, who in the meantime had been made marshal of France by Henry II., retired to Rome. Soon after, pope Paul IV. having quarrelled with king Philip II. of Spain, the latter sent the duke of Alba from Naples to attack Rome in 1556, and Piero Strozzi was entrusted by the pope with the defence of the city. Strozzi stood out bravely against the Spaniards, till the arrival of the duke of Guise with a French army obliged the duke of Alba to withdraw to Naples. After this Strozzi returned to France, and repaired to the French camp in Picardy to fight against the Spaniards and English. In 1558 he and the duke of Guise took Calais from the English, but shortly after Piero Strozzi was killed by a musket-shot at the taking of Thionville. His son Philippe attained high rank in the French service, and was killed in 1582, in the Azores Islands, whither he had been sent with an expedition by Henry III., or rather by queen Catherine de' Medici, to favour the claims of Don Antonio, claimant of the crown of Portugal against Philip II. of Spain.

Giambattista Strozzi, son of Lorenzo and nephew to Piero, was born at Florence in 1551, and was celebrated during a long life for his learning, his upright character, and his encouragement of useful knowledge. His house was a kind of school, to which young men fond of study resorted, and he gave them lessons gratuitously, and held disputations with them on various subjects of science. Those who were assiduous but poor he supplied with books, board, and other necessaries; and by so doing he greatly reduced his property. He was very intimate with the grand-duke Ferdinand I. and his son Cosmo II. When Urban VIII. was elected pope in 1623, he invited Giambattista Strozzi to Rome, gave him apartments in the Vatican, and delighted in his conversation; and when Strozzi departed to return to Florence, the pope sent him a letter, in which, among other expressions of esteem, he said that he wished that every town of Italy possessed a man like him. After his return to Florence he became blind, but continued to receive in his house and converse with studious men who resorted to him from all parts. He died in 1634, at eighty-three years of age. He was an elegant writer both in prose and in verse; some of his poems and dissertations have been published, but most of his works remain in MS. He began a poem entitled 'L'America,' concerning the discoveries of his countryman Amerigo Vespucci, but left it unfinished. Professor Rosini has inserted many interesting particulars of the life of Giambattista Strozzi, in his historical novel 'La Monaca di Monza.'

There are several other individuals of the name of Strozzi, belonging to various branches of the family, who became known in different parts of Italy for their learning. Francesco di Soldo Strozzi, a Florentine, but residing at Venice, translated into Italian Xenophon's 'History of Greece,' Venice, 1550, and also Thucydides, which last he dedicated to duke Cosmo, Venice, 1545, reprinted in 1563, but of which a much better edition was published at Verona in 1735. Oberto Strozzi of Mantua, a descendant of Tommaso above mentioned, was a patron of literature; he lived in the sixteenth century, and was a friend of Berni, Mauro della Casa, and other learned men. He founded a poetical academy at Rome, called 'dei Vignajuoli,' about 1534, which assembled in his own house, and whose meetings are recorded in high terms by Marco Sabino, in his dedication to Strozzi of the poetical 'Istituzioni' of Mario Equicola, in 1541.

Giulio Strozzi, born at Venice about the latter part of the sixteenth century, wrote poems: among others an epic, entitled 'Venezia Edificata.' He afterwards went to Rome, when he and Cardinal Doti founded an academy called Degli Ordinati, in opposition to that of the Umoristi. Strozzi was made Papal prothonotary, and died at Rome. Ciriaco or Chirico Strozzi, a Florentine, lived in the sixteenth century; he was professor of philosophy and of Greek at Bologna, and afterwards at Pisa, where he died in 1565. He composed a supplement to the 'Politics' of Aristotle, to supply the loss of the ninth and tenth books. Pietro Strozzi, also a Florentine, lived in the seventeenth century, and wrote a theological and controversial work, 'De Dogmatibus Chaldæorum,' with the view of converting the Nestorians of Me-

sopotamia to the church of Rome. (Tiraboschi; Pignotti; Fontanini.)

The palace Strozzi at Florence, built by the architects Da Majano and Pollajolo, in the time of the republic, is a remarkable specimen of the massive and stern style of Tuscan architecture of the middle ages. After the lapse of nearly four centuries it appears as perfect as if it were a recent structure. The colossal entablature which crowns the building is much admired.

STRUENSEE AND BRANDT have acquired celebrity from their extraordinary rise to rank and power, and still more so from their common fate. Their names are inseparably blended in history, and the life of the one can hardly be told apart from that of the other.

JOHN FREDERICK COUNT STRUENSEE was born at Halle in Saxony, on the 5th August, 1737. His father, a divine of some eminence, respected alike for his good qualities and for the orthodoxy of his principles, was professor of theology at the university of Halle, and his mother was the only daughter of John Samuel Karl, physician in ordinary to the king of Denmark. Both his parents took great pains in educating young Struensee, who, after the ordinary course of studies at the school attached to the orphan-house of Dr. Franke, entered the university in 1754, and applied himself to physic. The extraordinary talents which he possessed, and the facility with which he acquired everything bearing upon the science he had chosen, were strongly counterbalanced by licentious habits and a loose way of thinking on matters of religion. Being however under the control of his father, he obtained, with some distinction, his degree of doctor in medicine in 1757. In the same year his father was made pastor primarius at the principal church of Altona, where young Struensee himself obtained the appointment of public physician. Singular success attended him in the practice of his profession, and shortly after his arrival a few literary productions procured him the reputation of an author. He remained in this situation after his father's removal to Rendsburg in 1760, where he had been appointed superintendant-general of Sleswig and Holstein. It is to Struensee's stay in Altona that we must ascribe his knowledge of politics, little as it was, which he so ably employed afterwards in the days of his greatest prosperity. Here also he laid the foundation of that pernicious system of licentiousness which was at once the stimulus of his ambition and the cause of his ruin. It does not appear when he left Altona; but in 1768 we find him appointed to attend the king of Denmark, Christian VII., in his tour through Germany, France, and England. Struensee soon insinuated himself into the good graces of the king, with whose profligacy the loose principles and easy manners of his new physician were in perfect accordance; and such was the ascendency he gained over his royal master, that, shortly after his introduction to him, he ventured to promise Brandt, whose acquaintance he made at Paris, to use his influence in order to procure his recal from banishment. About the same time he met Count Rantzau, who afterwards played so conspicuous a part in the revolution which involved his ruin. At Paris a frequent intercourse with D'Alembert and Voltaire confirmed him in his infidelity, while the profligacy of the higher ranks gave exemption from the fear of scandal. We must not omit that it was during this journey of Christian VII. that the degree of D.C.L. was conferred on the king by the university of Oxford, and that of M.D. on Struensee. Soon after their return to Copenhagen the king himself presented Struensee to the queen Caroline Matilda, the posthumous daughter of Frederic, Prince of Wales, and sister of George III., and promoted him to the rank of privy counsellor. It appears however that the queen did not receive this new favourite of her husband with any marks of attention. It was only through the address with which Struensee reconciled her with the king, from whom she had been alienated in consequence of his excesses, that he became as acceptable to her as to her husband. He received every day from both of them new marks of consideration and esteem, and in 1770, having inoculated the crown-prince (Frederic VI., born in 1768), he was entrusted with his physical education. In his capacity of lecturer to the king, Struensee found ample opportunities of realising his ambitious plans. In order to supplant Count Bernstorff, or rather, to deprive him of his seat in the council of state, he recommended Count Rantzau-Aschbach. Soon afterwards he obtained the recal of his friend Enewold von Brandt, who was raised to the dignity of *maître des plaisirs* and director of the plays, instead of the old favourite Count von Holk. Brandt's polished manners, his easy address, and his lively conversation, were qualities well calculated to promote his favour with the court, where it was of the greatest importance to Struensee that none but his friends should have any influence. It was chiefly through Brandt that he finally succeeded in dismissing Count Bernstorff from the service; many other men of quality were obliged to leave their situations, and the queen dowager Juliana Maria soon found herself without power, neglected by her friends, and slighted by her enemies. The triumph of Queen Caroline was complete; the king behaved to her with deference, and Struensee was now constituted first minister with almost unlimited power. Thus matters stood at the end of 1770, when of the two parties striving for the power which the king had almost resigned, that of the young queen under the guidance of Struensee obtained a decisive victory. In order to be in perfect security, Struensee assigned to Brandt the special office of amusing the king and preventing him from having any conference with his ministers.

It was about this time that the king, urged by Struensee, dissolved the council of state, and instituted in its place a commission of conference (*Commissions conferenz*), which consisted of the presidents of the several branches of public administration. This measure brought all the power into the hands of the prime minister, by whom the members of this new council had been appointed. It changed at the same time the whole Danish constitution by depriving the nobility of their hereditary influence in the affairs of the government, created a universal feeling of disapprobation, and brought much popular odium on Struensee. So limited were the powers of this new chamber, that it could assemble only at certain times, and might be dismissed by the minister; in fact, its members had neither rank, power, nor influence. The imprudence with which this measure was carried into effect could not but prejudice the queen's cause. Among the many enemies which it created, few were so exasperated as Count Rantzau, who, with his seat in the council of state, lost all his power and authority. In order to revenge himself, he joined the queen dowager at Friedensburg. This sudden change in the administration had however the desired effect. Struensee's authority became paramount, and no one ventured to oppose him. The ministers were removed one after the other. All affairs were carried on under the immediate direction of Struensee, and all papers passed through his hands before their ratification by the king. He soon found however that notwithstanding his qualifications for managing the foreign affairs of the kingdom, he had no present means of restoring the exchequer and regulating the home department, both of which had long been declining under the administration of persons utterly devoid of prudence and unacquainted with the resources of the country. His brother C. A. Struensee, member of the college of finance, assisted him in his intended improvements; but the taxes which he imposed produced great destitution among the lower classes, a circumstance which, joined to the despotism exercised over them by a foreigner, increased the number of malcontents and the dissatisfaction of the people. All this time the king was surrounded by libertines, by whom the court was plunged into a profligacy which offended the nation. Meanwhile the attachment of the queen to Struensee exceeded, in appearance at least, the bounds of all moderation. In July, 1771, she was delivered of a princess, and her fears of the infamous reports which were likely to spread from the court of the queen dowager at Friedensburg tended only to place her after this event still more in Struensee's power. This power he shamefully abused. He was raised to the dignity of a count, together with his friend Brandt, and there is reason to believe that much of the enormous wealth of which he died possessed was wrung from the queen's weakness. But though the queen's fears made her silent, it was not so with the press. Its comments on Struensee's proceedings could not be silenced, except by revoking the freedom which he had granted only two years before with the hope of obtaining popularity. This proceeding, as well as the many slights he offered to his former friends, raised the indignation of the people to the highest pitch, and even those who were most attached to him treated him with reserve and coldness. At this crisis too his mental powers began to fail; the daring which had founded his administration, and the quickness in planning and boldness in exe-

enting which sustained it, gave place to a weak and vacillating fear of his daily increasing difficulties. An unimportant mutiny of 300 sailors who had not received their pay had already shaken Struensee's firmness, and was followed by a revolt of the life-guards, whom he had dismissed without any cause.

On this occasion Struensee acted in a manner unworthy of a man in power; he acceded to all the demands of the revolted soldiers, and sought to conciliate them by various means. This disclosure of his weakness of character, to which succeeded measures evidently calculated to secure his personal safety, led the English ambassador to warn the queen of the approaching downfal of the favourite. The regard he felt for her made him even go farther, and request that she would remove Struensee from the court, in order to prevent the catastrophe which he foresaw. But all his entreaties were in vain. The queen trusted too much to Struensee's prudence, who now made some changes in the department of police, with the view of securing himself against any danger. But the purport of those measures was too manifest. The people naturally enough concluded that Struensee was conscious of having slighted the nation, and they began to see that the prime minister was only a fortunate adventurer, whose career was drawing to a close. The partisans of Juliana Maria and her son Prince Frederic regarded this as an opportunity for a coup d'état too favourable to be neglected. They planned a conspiracy with so much secrecy that nothing whatever transpired which could have put Struensee on his guard. Early in the morning of the 17th January, 1772, Queen Matilda, Struensee and his brother, Brandt, and all their friends and adherents, were arrested. The evening before a ball had been given in the royal palace. Struensee, conscious of his own unpopularity, had, according to his custom, surrounded the palace with guards on whose fidelity he thought he could rely. General Eichstädt, who had been gained over by the opposite party, changed the soldiers, substituting his own dragoons in their place. That evening the young queen danced much, and closed the ball with Prince Frederic, about one o'clock. At three in the morning, Colonel Köller, an old enemy of Struensee, sent his officers into the palace, telling them that he had orders from the king to arrest the queen. At the same time the conspirators—the Queen Dowager, Prince Frederic, Rantzau, Köller, Güldberg, and Eichstädt—went into the king's bedchamber, and forced him to sign the order for the seizure of Struensee and his partisans. The unfortunate queen was brought to Kronenburg, where she was confined until the end of May, 1772, when she was set at liberty through the influence of the English government, and was removed to Zelle.

Meanwhile a special commission was formed, in order to try Struensee. The charge, consisting of nine heads, was given to the fiscal-general on the 22nd April, 1772. During Struensee's imprisonment, Dr. Münter succeeded in converting him from scepticism to Christianity: the narrative of his conversion was published, first at Copenhagen, in 1788, and translated into English by the Rev. Mr. Wendeborn, and republished in 1826 by Thomas Rennell. By the sentence, which was pronounced on the 25th April, 1772, Struensee was to be deprived of all his dignities and beheaded. His right hand was to be cut off, his body quartered and broken on the wheel, and his head and hand were to be stuck up on a pole. This sentence was confirmed by the king in every point; and, on the 28th April, Struensee was decapitated, after witnessing the death of his friend Brandt. Struensee was undoubtedly a man of great abilities, capable of great application to business, rapid and decisive in his resolutions, as well as enlarged and patriotic in his views; but he neither possessed the profound policy, the active vigilance, nor the superior judgment requisite for maintaining him in his sudden elevation. Towards the close of his ministry he acted without foresight or address, as if, with the difficulties which augmented around him, he lost his presence of mind and strength of understanding. Voluptuousness was the source of his misfortunes; ambition only contributed to hasten and complete them. His ignorance of the language of the country which he for some time ruled made him commit many mistakes which otherwise he would have avoided. Nevertheless the charges brought against him are heavy, especially that of peculation; he had on various occasions used the public money for the purposes of himself and his friends, and on one occasion he took 60,000 dollars to remunerate himself for his services, and gave an equal sum to Brandt. He also brought the court of Denmark into habits of dissipation, which, from thence, spread throughout the capital. His friend Brandt was formerly chamberlain to Christian VII.; but having calumniated Count Holk, the then favourite of the king, he was banished from court. Struensee, as above stated, recalled him in 1770, and from that period his life was but a copy of that of the prime-minister. He was violent and imprudent, and once so much forgot himself as to strike the king. This crime was forgiven by Christian VII.; it was therefore not this insult to the king's majesty which brought him to the block. That imprudent act served indeed as a pretext on which to found the accusation, but it was not his real crime; he merely suffered for his political and private connection with Struensee. The sentence pronounced on him was similar to that of his friend.

(Jens Kragh Höst, *Der geheime Cabinetsminister Graf Struensee und dessen Ministerium*, which is the best book on the subject: *An Authentic Elucidation of the History of Counts Struensee and Brandt*, 1788, a book containing many unfounded and incorrect assertions; Falken Skiold's *Mémoires*, Paris, 1826; and *A Narrative of the Conversion and Death of Count Struensee*, by Dr. Münter, London, 1826, containing also Struensee's famous confession.)

STRUENSEE, CARL AUGUST VON, brother of the foregoing, was born at Halle, on the 18th of August, 1735, and entered the school of the orphan-house and the university of that town. The wish of his father was that he should study theology; but although he was matriculated in the theological faculty, young Struensee chiefly applied his mind to mathematics and philosophy. In 1756 he was appointed a lecturer at the university of Halle; his lectures on mathematics and Hebrew were well attended, and procured for him some reputation. As early as 1757 he obtained a professorship at the military academy of Liegnitz. The scantiness of pupils which the war had occasioned gave him leisure to study the application of mathematics to the science of war, and in 1760 he published his 'Rudiments of Artillery' (3rd edition, Leipz., 1788). This work procured him the favour of Frederic II., who sent him a great number of young officers whom he was to form for the service. In 1771 appeared his 'Rudiments of Military Architecture,' the third volume of which appeared in 1774; they were republished at Leipzig in 1786. This was the first good book on the subject published in Germany. Meanwhile his brother, who had lately made his appearance at the court of Copenhagen, invited him to that city in 1769. Here he was raised to the dignity of counsellor of justice, and such was his application in the performance of his duties and the judgment with which he avoided all party strife, that after the downfal of his brother, he was set at liberty after a short imprisonment, and permitted to return to his country. Frederic II. received him with kindness, and offered to him the yet vacant place at the academy of Liegnitz; but he refused the offer, and retired to his country-seat of Alzenau, in the neighbourhood of Haynau in Silesia, where he pursued his political and mathematical studies. Here he translated Pinto's 'Essays on Political Economy' (1776), to which he added, in 1777, a second volume containing Essays of his own. These were augmented and republished in three volumes, Leipzig, 1800. It was here also that he wrote 'A Short Description of the Commerce of the principal European States,' a work which was completed by Sinapius, and contains very important notices on the trade of the Prusso-Polonic states. Upon this he was raised to the rank of counsellor of finances, and appointed at Berlin director of the maritime trade. In this capacity he distinguished himself by his extraordinary zeal and his politic measures, and soon effected a rise in the trade, which had much suffered under former administrations. For these services he was made a noble, and received the name of Karlsbach in 1789; two years afterwards he was appointed minister of state and president of the board of excise, in which situation he died, on the 17th of October, 1804.

He was a man of clear and enlarged views, remarkable presence of mind, firm principles, and strict order. He showed himself able to appreciate talent, and this circumstance contributed very much to the amelioration of the departments over which he presided; yet he is not free from the charge of nepotism. He shrank from innovation, and abstained from reforming even where his judgment con-

vinced him that it was necessary to do so. His youngest brother was director of the bank at Elbing about 1777.

STRUMA. [SCROPHULA.]

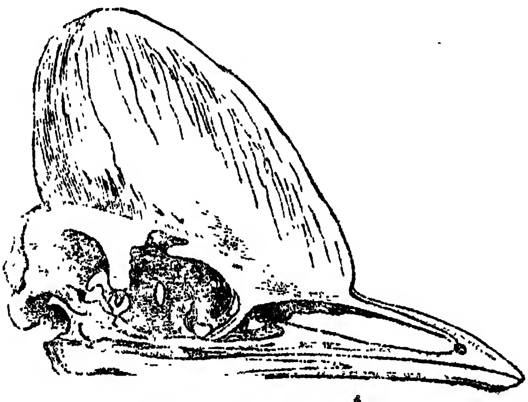
STRUTHIOLA'RIA. [SIPHONOSTOMATA, vol. xxii., p. 54.]

STRUTHIO'NIDÆ, a natural family of terrestrial birds, in which the locomotive energy is thrown into the lower extremities, the wings being in no case adequate to raising the body into the air, and in the majority of instances merely rudimentary. In this respect the genera which compose it are the very reverse of the Humming-birds, Swallows, Albatrosses [ALBATROSS; PETRELS, vol. xviii., p. 46, &c.], Tropic birds, and Man-of-War bird; for in the latter the moving-power resides in the highly developed wings, whilst the feet, especially in the Man-of-War Bird [PELECANIDÆ, vol. xvii., p. 386], are feeble.

The *Struthionidæ* consist of the Ostrich, American Ostrich (*Rhea*), Cassowary, New Holland Cassowary, or Emu, the Dodo (too probably extinct), and that extraordinary bird the *Kivikivi*, or Apteryx, of New Zealand.

Organization.*

Skeleton.—The most remarkable modifications of the *Skull* in this family occur in the Asiatic Cassowary and the *Apteryx*. In the former the bony crest, which is so highly developed in the adult, is hardly perceptible in the young bird, but increases with age, as in the HORNBILL and the Guinea hen. [PAVONIDÆ, vol. xvii., p. 340.]



Skull of Asiatic Cassowary (adult)

Skull of Asiatic Cassowary (young).

In *Apteryx*, according to Professor Owen, the skull is chiefly remarkable for its smooth expanded elevated pyriform cranial portion, the total absence of supra-orbital ridges, the completeness and the thickness of the inter-orbital septum, the great development of the ethmoid, the small size of the lachrymal bones, and the expansion of the nasal cavity behind these bones. The tolerably semicircular occipital region differs from that of other *Struthionidæ* in the greater relative extent of its base, and in the comparatively slight lateral sinuosities due to the temporal depressions. There is no vertical notch at the upper part of the single hemispherical tubercle in the basi-occipital for articulation with the atlas, as in the *Ostrich* and *Emu*, but it is entire, as in *Rhea*; the plane of the occipital foramen also has the same aspect as in that bird, in which it is more nearly horizontal than in the *Ostrich*. The supra-occipital plate forms a somewhat angular projection, corresponding with the small cerebellum, and is bounded on each side by a vertical vascular groove terminated by a foramen above and below; the ex-occipitals extend outwards and downwards external to these grooves in the form of obtuse processes compressed in the antero-posterior direction, and are slightly convex behind and concave in front, where they form the back part of the wide meatus auditorius externus. The occipital bones, and also the surrounding bones, were anchylosed together. The angle between the posterior and superior regions of the cranium can hardly be said to be produced into a ridge. The superior region is smooth, convex, and separated from the temporal depressions by a narrow ridge, rather more marked than the occipital ridge. The sagittal suture crosses a little behind the middle of the upper part of the cranium. In one cranium Professor Owen found the left half of this suture persistent; but in another, that of a male, all the sutures were obliterated. The persistent sutures were more denticulated than those in the skull of a young *Ostrich*. The superior region is continued into the lateral regions by a continuous curvature, so that the upper part of the small orbital cavity is convex, and its limits undefinable, there being no trace of supra-orbital ridge, nor of antorbital or postorbital processes. This structure, Professor Owen observes, is quite peculiar to the *Apteryx* among birds, but affords a very interesting resemblance between it and the monotreme *Echidna*. The slender zygomatic process sent forwards by the temporal bone most resembles that of *Rhea* in its small relative development. Between the frontal bones, which gradually contract to their junction with the nasal bones, a small part of the ethmoid may be traced. The narrow frontal region is traversed by a mesial longitudinal depression. The ethmoid bone is remarkably expanded; its cells, instead of being restricted to a narrow vertical septum of the orbits, as in the diurnal *Struthionidæ*, occupy not only the ordinary orbital space, but extend outwards for more than two lines beyond the lateral boundaries of the anterior part of the frontals. A small process extends from the frontal to the side of the expanded ethmoid, anterior to the orbital foramina, which are distinct and remarkably wide apart, and the ethmoid, which is nine lines in breadth, is also supported anteriorly by a similar anchylosed conjunction with the lachrymal bone. The Professor remarks that the nearest approach to this peculiar structure of the *Apteryx* is made by the *Ostrich*, in which last the interorbital septum, though much thinner than in the *Apteryx*, is also occupied by ethmoidal cells, and is thicker than in any of the other large *Struthonidæ*. The *Ibis*, he observes, offers a striking contrast with the *Apteryx* in this respect, the interorbital osseous septum being almost entirely absent; and it also differs widely in all the other parts of the cranium already noticed. In the posterior region of the skull of the *Ibis* the long covering of the cerebellum is, as he states, in great part defective: in the superior part, the cranial parietes above the cerebral hemispheres form two convexities separated by a middle longitudinal depression, and the narrow space between the supra-orbital ridges is occupied by the impressions corresponding to the nasal or supra-orbital glands; the whole cranium also is much higher and shorter in proportion to its breadth than in the *Apteryx*; and Mr. Owen remarks that the *Ibis*, in thus differing from the *Apteryx*, deviates also from the other *Struthionidæ*.

The base of the skull of *Apteryx* exhibits all the peculiarities characteristic of the Struthious birds. The body of the sphenoid sends out two processes on each side externally; the posterior of these abuts against the tympanic bone, and the anterior one by a flattened oval articular surface against the pterygoid bone. Professor Owen points out that the latter processes exist, but are much more feebly developed in the *Ibis*, and that in most other birds, including the *Grallæ*, they are wanting, whilst they are well developed in the Lacertine *Sauria*. A compressed vomerine process is continued forwards from the anterior part of the basi-sphenoid, and this process is anchylosed to the under part of the expanded and cellular ethmoid.

The olfactory depressions in the interior of the cranium are proportionally larger than in other birds, and the olfactory nerve, instead of being continued along the upper part of an interorbital septum by a bony canal or groove to the nasal cavity, immediately passes by many perforations through a cribriform plate to the complex and extensive pituitary surface of the ethmoid bone.

Both internally and externally the optic foramina are distinct and half an inch apart; they are perforated not in the sphenoid ala, but in the inflected margin of the frontal bone. 'In these peculiarities the *Apteryx* differs from all the rest of its class; each optic foramen however transmits not only the optic nerve and ophthalmic artery, but also the third, fourth, first branch of the fifth, and sixth nerves, as in

* The anatomy of *Apteryx* is entirely taken from Professor Owen's paper in the second volume of the 'Transactions' of the Zoological Society of London.

most other birds. Of these nerves the fifth is the largest, and it is continued forwards to the nasal canal, through two foramina, one circumscribed externally by the process already mentioned, which extends from the frontal to the ethmoid; the other, by the corresponding process of the lachrymal. The pituitory fossa, or sella turcica, is a very deep semi-oval depression; the common internal orifice of the two carotid canals communicates with its posterior part. On each side of the anterior part of the floor of the cranium, which supports the medulla oblongata, there is an oblique slightly curved groove, terminated at its anterior extremity by the *foramen rotundum*, at its posterior by the *foramen ovale*. These *foramina* are situated between the basilar and alar elements of the sphenoid; they are nearly of equal size, and are relatively longer than in the diurnal *Struthionidæ*. The foramen rotundum is not only distinct, but is farther apart from the *foramen opticum* than in any other bird. The petrous bone projects internally in the form of a thin semicircular plate of bone, commencing at the foramen ovale and extending backwards to the foramen auditorium internum, which it overhangs: this plate gives attachment to the tentorium. There is not any corresponding bony ridge developed from the upper wall of the cranium in the line of origin of the falx, as in many of the gallinaceous birds. The anterior or cerebral division of the cranial cavity is larger in proportion to the posterior than in most other birds.'

The tympanic bone is trihedral, subcompressed, and sends forwards into the orbit a process longer and more slender than that in the larger *Struthionidæ*: its upper articular surface is a transversely extended convex condyle, playing in a corresponding cavity internal to the base of the zygomatic process. The opposite and expanded extremity presents two distinct articular convexities for the lower jaw, the inner being the largest; a small but deep depression for the reception of the deflected extremity of the jugal bone exists above the external convexity. Between the orbital process of the tympanic and the transverse process of the sphenoid bones, the posterior extremity of the pterygoid bone is securely wedged in, and, advancing forwards, expands, as in the other *Struthionidæ*, into a thin plate of bone, which is bent upon itself with its concavity turned inwards, and is continued by anchylosis into the palatine bones, so that the limits between them are indefinable. So also the palatine bones are confluent with the maxillaries: the former are pierced by two narrow elliptical posterior nasal foramina, about three lines in length, over which the external margin of each palatine bone arches from without inwards. These overarching laminæ gradually approach each other, as they advance forwards, and meet about an inch anterior to the nasal foramina, from which an imperforate plate of bone, with a narrow median fissural impression, and composed of the confluent palatal processes of the maxillary and intermaxillary bones, is continued to the end of the beak, the limits between those bones being indicated by two fine oblique lines arising at the outer margin of the roof of the mouth, about two and a half inches from the apex of the beak. The jugal style in *Apteryx* consists of a single slender, compressed, twisted bone, anchylosed with the maxillary bone in front, and terminated behind by an obtuse deflected extremity, which is received into a corresponding vertical cavity in the upper part of the outer process of the tympanic bone. In the full-grown Ostrich this bone is separable into a zygomatic and malar portion. By the mode of attachment adopted in *Apteryx*, the tympanic bone offers increased resistance to the pressure transferred to it by the lower jaw, at the same time that it gives additional strength to the upper mandible. As in the other *Struthionidæ*, it is continued backwards in the same line with the upper maxillary bone, and is not bent downwards at its junction with the maxillary, as in the *Ibis* and other *Grallæ*. The superior maxillary bone is singular, presenting the form of an elongated triangular plate of bone nearly perfectly flat, imperforate, and continued with the intermaxillary by uninterrupted ossification. Of the *Struthionidæ*, *Rhea* comes nearest to *Apteryx* in the structure of this part of the skull; but in *Rhea* large *foramina* perforate the maxillary plate, which sends upwards on each side a process to join the lachrymal. The superior maxillary bones of the *Ibis* are slender round styles, with a wide interspace between them. Two compressed plates of bone, descending obliquely forwards from the anterior extremities of the frontals, and articulated below to a small depression in the maxillary plate, each pierced by a single small foramen, represent the lachrymal bones in *Apteryx*. The continuous bony piece formed by the frontal, nasal, and intermaxillary bones is too strong to admit of any elastic yielding movement between the upper jaw and cranium. The nasal and the upper or mesial portions of the intermaxillary bones form an elongated depressed narrow process, convex above, with external margins bent inwards beneath the long nasal passages, of which they form the outer and part of the lower boundaries.

The usual ornithic characters, with the Struthious modifications traceable in the individual peculiarities, are presented in the lower jaw of *Apteryx*. 'The transversely expanded angular and articular extremities offer the inwardly extended process for the attachment of the *pterygoidei* muscles; the superior transverse plate, behind the articular surfaces, is thin and concave towards the *meatus auditorius externus*, and is lined by the mucous membrane of that passage, of which it forms part of the bony parietes. There are two distinct narrow oblique articular surfaces, concave in the longitudinal and convex in the transverse directions; the internal one is the largest, and behind this there is a small excavation, into which a small process of the air-sac lining the tympanum is continued; and this is the only part of the skeleton not immediately concerned in the formation of the organs of hearing or smelling into which air is admitted. The entry to the air-cells, in the lower jaw of the *Ostrich*, is situated in the part corresponding to the above depression or sinus in the jaw of *Apteryx*. Traces of the compound structure of the lower jaw are very evident in that of the *Apteryx*, and the limits of the angular, articular, and coronoid pieces may be in part defined. There is a linear vacancy, bounded by the surangular and angular pieces behind, and by the bifurcate commencement of the mandibular or dentary piece in front: the surangular is compressed, and sends upwards a very slightly elevated coronoid ridge. A second narrower fissure occurs between the thick opercular or splenial element and the upper fork of the mandibular piece. The opercular piece reaches to the posterior part of the symphysis, as in the *Ostrich*, and the rest of the lower jaw in front of this part is formed by the two anchylosed mandibulars. In the extent of this anchylosed symphysis, the *Rhea* makes the nearest approach to the *Apteryx* among the *Struthionidæ*, and the two impressions which diverge from the back part to the front of the symphysis are present in both the *Rhea* and *Emeu*, as in the *Apteryx*. The lower jaw of the *Apteryx* differs from that of the *Ibis* in its greater posterior expanse, its more depressed form, the lower coronoid plate, the narrower fissure between the angular and surangular pieces, and the absence of the mesial furrow, extending in the *Ibis* to the end of the symphysis.'

Vertebral Column.—The number of the *cervical* vertebræ in the *Ostrich* is eighteen, in the *Cassowary* sixteen (true), in *Rhea* sixteen (not fourteen, as Cuvier states), in the *Emeu* nineteen, in the *Apteryx* fifteen only; and in the latter there are nine dorsal, and twenty-two remaining vertebræ in the lumbar, sacral, and caudal regions: the spinal column of *Apteryx* is relatively stronger, especially in the cervical region, than it is in the larger *Struthionidæ*. The length of the cervical region, the vertebræ of which present the usual ornithic characters, is seven inches: that of the *dorsal* region four inches, and that of the portion of the column behind the dorsal vertebræ included between the ossa innominata, three inches. The structure of the vertebræ is minutely detailed by Professor Owen, who observes that the close resemblance of the bird to the reptile in its skeleton is well exemplified in the young *Ostrich*, in which even when half grown the costal appendages of the cervical region continue separate and moveable, as in the *Crocodile*: those the Professor found anchylosed to the first fifteen vertebræ in *Apteryx*.

The nine caudal vertebræ of *Apteryx* are deeper and project farther below the posterior portions of the iliac bones than in the other *Struthionidæ*. The spinal canal is continued through the first five of these vertebræ, which, as they descend, progressively increase in lateral and diminish in vertical extent, and are all moveable upon each other except the two last, which combine to form a vertebra analogous to the expanded terminal vertebræ in other birds, but which in *Apteryx* exceeds the rest only in its greater length, and gradually diminishes to an obtuse point. Professor Owen proceeds to remark that in the *Ostrich* the

corresponding vertebra is expanded for the support of the caudal plumes, but that in *Apteryx* it offers the same in conspicuous development as in *Rhea* and the *Emeu*.

The first dorsal *rib* in *Apteryx* is described as a slender style about an inch in length, and the rest as remarkable for their breadth, which is relatively greater than in any other bird; the *Cassowary*, in this respect, is stated to approach nearest to the *Apteryx*. 'The second, third, fourth, and fifth ribs are articulated with the sternum through the medium of slender sternal portions; that of the sixth also reaches the sternum, but is attached only to the external rib anterior to it, and a considerable interspace exists between its unattached extremity and that of its corresponding vertebral rib. In the first simple and floating rib, the part corresponding to the head and neck, as usual, is not developed, and it is attached to the transverse process by the part analogous to the tubercle. In the second rib a short and strong cervix terminated by a hemispherical head is given off below and in front of the tubercle, and works in a corresponding socket at the anterior margin of the vertebra. The head and tubercle, with the points of the vertebræ to which they are attached, intercept large foramina corresponding to the vertebral foramina in the cervical region. Immediately below the tubercle the rib suddenly expands, and then gradually narrows to its lower end; the neck of the rib increases in length in the third and fourth pairs, and diminishes in the last two; the sixth rib begins to lose its breadth, and the rest become narrower to the last. The bony appendages to the vertebral ribs are developed in the second to the eighth inclusive: they are articulated by a broad base to a fissure in the posterior margin of these vertebral ribs a little below their middle part; those belonging to the third, fourth, fifth, and sixth ribs are the longest, and overlap the succeeding rib: these processes are not anchylosed in the specimen described. The *Rhea* comes nearest to the *Apteryx* in the size of these costal appendages. The first four sternal ribs are transversely expanded at their sternal extremities, which severally present a concave surface lined with smooth cartilage and synovial membrane, and playing upon a corresponding smooth convexity in the costal margin of the sternum, which thus presents four enarthrodial joints with capsular ligaments on each side. This elaborate structure is not however peculiar to the *Apteryx* among birds, but relates to the importance of the movements of the sternal ribs, which are the centres upon which the respiratory motions hinge,—the angles between the vertebral and sternal ribs, and between these and the sternum, becoming more open in inspiration when the sternum is depressed, and the contrary when the sternum is approximated to the dorsal region in expiration.'

In the *Struthionidæ* we look in vain for the deep crista or keel which so strongly marks the well-developed ornithic character, especially in the diurnal birds of prey, the larger sea-birds above alluded to, and the humming-birds. Such a foundation would be worse than useless where there is none of the machinery of flying to be worked, and the utmost demand on the anterior extremities goes no farther than their aid in balancing the body when the bird runs. We accordingly find that in the larger *Struthionidæ* (Ostrich, Cassowary, &c.) the breast-bone presents a plane and uniformly arched shield-like surface, not unlike, in some of the family, the Cassowary and Emeu for instance, to a Highlander's target on a reduced scale. But in the *Apteryx* this low development is reduced to its lowest grade. In its small size, and in the total absence of a keel, it resembles, Mr. Owen observes, that of the Struthious birds generally, but differs in the presence of two subcircular perforations on each side of the middle line, in the wide anterior emarginations, and in the much greater extent of the two posterior fissures. The anterior margin, he tells us, presents no trace of a manubrial process, as in the *Ostrich*: on the contrary, the wide interspace between the articular cavities of the coracoid is deeply concave; in the extent of this interspace, he remarks, the *Rhea* most resembles the *Apteryx*, but its contour is almost straight; whilst, in the *Cassowary*, the space is narrower, but deeply notched. The articular surface for the coracoid is an open groove, which in the fresh state is covered with articular cartilage; and, external to the groove, the anterior angles of the sternum are produced into two strong triangular processes with the apex obtuse. The thickened costal margin, when viewed anteriorly, presents an undulating contour, from the presence of the four articular convexities, for the sternal ribs and the intermediate excavations. The sternum of the *Emeu*, Mr. Owen remarks, presents a similar appearance. The breadth of each sternal perforation is, he adds, nearly equal to that of the intervening osseous space, and in the specimen described they were not quite symmetrical in position. The posterior notches equal in extent one half the entire length of the sternum, and the external boundaries of these notches curve towards each other. These notches exhibit a slight want of symmetry in form, position, and extent.

There is no true *furcula* in the *Struthionidæ*, but the *Ostrich* and *Cassowary* have on each side of the front of the chest an elongated flat bone consisting of a rudiment of the furcula, with the clavicle and scapula consolidated into one piece. The two branches of this rudimentary furcula are very short, and never united in the African *Ostrich*, but anchylosed with the bones above mentioned. In the *Cassowary* there are merely two little processes from the side of the clavicle: these are the rudiments of the branches of the fork. In the *Emeu* two very small thin bones are attached to the anterior edge of the dorsal end of the clavicles by a ligament, and are directed upwards towards the neck: there they are fastened to each other by a ligament, but have no connection with the sternum. In the *Apteryx* the *scapula* and *coracoid* are anchylosed; and a small perforation anterior to the articular surface of the humerus indicates the separation between the coracoid and rudimental clavicle, of which, Professor Owen states, there is not otherwise the least trace. The coracoid, he adds, is the strongest bone; and its inferior expanded extremity presents an articular convexity, adapted to the sternal groove before described. The third rib is reached by the scapula, which is a simple narrow plate of bone, one inch in length, slightly curved, and expanded at both ends, chiefly at the humeral articulation.

The true *wing bones* are best developed among the Struthious birds in *Rhea*; the next best development is in the *Ostrich*: in the *Cassowary*, *Emeu*, and *Apteryx*, the lowest development of these bones is exhibited. In the latter the *humerus* is a slender, cylindrical, styliform bone, one inch and five lines in length, and slightly bent. At the two extremities it is slightly expanded, but most at the proximal end, which supports a transverse oval articular convexity, covered with smooth cartilage, and joined by a synovial and capsular membrane to the scapulo-coracoid articulation. Beyond each end of the humeral articular surface is a small projecting tuberosity. The distal end of the humerus is articulated by a true but shallow ginglymoid joint with the rudimental bones of the antibrachium, and both the external and internal condyles are slightly developed. The slender *radius* and *ulna*, each nine lines in length, are almost straight and cylindrical. Above the articular surface of the ulna a feebly developed *olecranon* is projected. A minute carpal bone, two metacarpals, and a single phalanx, which supports the long curved obtuse alar claw, complete this rudimental hand, which is seven lines in length, including the claw, and that measures three lines and a half. To the ulna and metacarpus a few short and strong quill-feathers are attached by ligament.

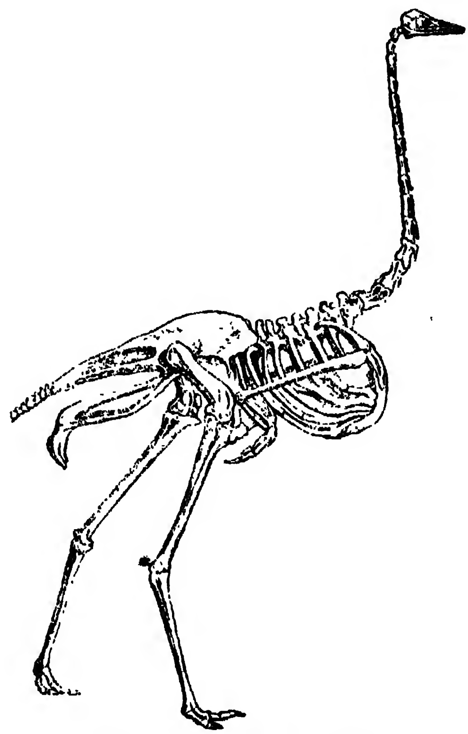
Strongly contrasted with the flattened sternum and the dwindled anterior extremities are the strongly developed *pelvis* and posterior limbs of the *Struthionidæ*. The pelvis of the ostrich bears some resemblance to that of the extinct quadrupedal *Mylodon*, of which there is now a noble skeleton in the museum of the Royal College of Surgeons. In this part of the osseous system we have ample fulcra for those powerful muscles which render the larger Struthious birds swifter than the swiftest. The iliac bones of *Apteryx* resemble those of the rest of the tribe in size and shape, and are four inches and three lines in length. There is a slight anterior concavity on the outer surface, and this concavity passes into a convexity posteriorly, the two surfaces not being separated by the transverse elevation which exists above the acetabulum in the four large *Struthionidæ*. Between the posterior extremity of the ilia and the first three caudal vertebræ, a distinct epiphyseal piece of bone is wedged in. The ischium extends backwards parallel with the sacrum, in the form of a thin plate of bone, which slightly expands to its free and truncated extremity. The pubic element is a slender bony style, connected by ligament to the end of the ischium, but attached by bone at its acetabular extremity only. A short pointed process extends from the anterior margin of the origin of the pubis. In comparing the pelvis of *Apteryx* with that of the large

Struthious birds, Professor Owen observes that the ischia do not meet below the sacrum, as in the *Rhea*, but are more distant from that and the iliac bones than in any of the *Struthionidæ*; the pubic bones, he remarks, are not joined together at their distal extremities, as in the *Ostrich*; nor are the extremities of the ischia anchylosed to the superincumbent ilia, as in the *Cassowary*. It is the *Emeu*, he adds, that comes nearest to the *Apteryx* in the structure of the pelvis, but it also differs in the complete bony boundary of the foramen, which transmits the tendon of the obturator internus, and which is completed posteriorly by ligament in *Apteryx*. The acetabulum, he observes, communicates, as usual, by a wide opening with the pelvis, and a surface covered with a cushion of thick cartilage is continued from its posterior and upper part.

The great length of leg in the *Struthionidæ* is produced, as in the true wading-birds, by the tibia and common bone of the tarsus and metatarsus; for the femur is comparatively of short dimensions.

The fibrous capsule of the hip-joint of *Apteryx* is very strong; the synovial membrane is reflected from it upon the upper margin of the trochanter and upper part of the short neck of the femur, as well as upon the ligamentous bridge, continued from the upper and extended margin of the acetabulum to its anterior part. The very large *ligamentum teres* is short, and consists of an infundibular process of synovial membrane, reflected from the circumference of the acetabular perforation to that of the depression on the head of the femur: this synovial sheath encloses two distinct ligaments, which are twisted about each other like the crucial ligaments of the knee-joint. One of the ligamentous bands passes from the upper margin of the acetabular perforation to the lower edge of the femoral depression.

The small round head of the *femur* (which last possesses in *Apteryx* the usual ornithic character, and is three inches nine lines in length) is supported on a very short and thick neck, placed at right angles to the great and single trochanter, and presents at its superior part a large depression for the strong and complicated ligamentum teres; its shaft is slightly bent with the convexity forwards, and this is increased by a thickening at the anterior part of the middle of the shaft. The condyles are separated anteriorly by a wide and deep groove, and, behind, by a triangular depression. The outer condyle is the largest, and has an external groove for the articulation of the head of the fibula: the inferior compressed border of the condyle is wedged in between the tibia and fibula. Two angular and strong ridges are developed from the anterior part of the expanded end of the *tibia*, which is five inches in length: the external one affords attachment to the fascia and to the expanded tendon of the rectus femoris latissimus; to the internal ridge is affixed the ligament of the small cartilaginous *patella*. The knee-joint is very complex. The broad and thin internal lateral ligament gives origin to part of the soleus, and is attached to the internal semilunar cartilage. This fibro-cartilage divides at its anterior extremity into three ligaments: one broad and thick, going to the posterior surface of the rotular cartilage, and representing the ligamentum mucosum; the other two inserted at the interspace of the condyles. A very strong ligament arises from the inner edge of the tibia beneath the internal semilunar cartilage, and is also attached to the same interspace. A strong external lateral ligament extends between the outer condyle and the head of the fibula; and beneath or within this there is a second ligament, which passes from the outer *condyle* to the external semilunar cartilage. From the anterior parts of this cartilage a thick ligament extends to the back part of the ligamentum patellæ. From the back part of the external semilunar cartilage a posterior crucial ligament extends to the condyloid interspace; and, lastly, a strong ligament arises from the fore part of the head of the tibia, and passes upwards and backwards, to be inserted, with the preceding ligament, into the back part of the interspace of the condyles. The head of the tibia sends down an angular ridge posteriorly: the shaft is rounded, slightly compressed, converging to a ridge externally, to which ridge the *fibula* is attached in two places, beginning half an inch below the head of the fibula, and continuing attached for ten lines: then again becoming anchylosed, after an interspace of nine lines. In one specimen, Professor Owen found the fibula also anchylosed to the tibia by its expanded and thick proximal extremity; in descending it rapidly diminishes in size, and gradually disappears towards the lower fourth of the tibia, whose distal end presents the usual trochlear form, but the anterior concavity above the articular surface is in great part occupied by an irregular bony prominence. A small cuneiform tarsal bone is wedged into the outer and back part of the ankle-joint. The strong anchylosed tarso-metatarsal bone is two inches three lines in length, and the upper articular surface is formed by a single broad piece. Professor Owen points out that the original separation of the metatarsal bone below into three pieces is plainly indicated by two deep grooves on the anterior and posterior part of the proximal extremity; and that



Skeleton of Ostrich. (Pander and D'Alton.)

Skeleton of Apteryx. (Owen.)

the intermediate portion of the bone is very narrow anteriorly, but broad and prominent on the opposite side. The bone is flattened from before backwards, and expands laterally as it descends, dividing at its distal extremity into

three parts, with the articular pulleys for the three principal toes. The surface for the articulation of the fourth or small internal toe is about half an inch above the distal end, on the internal and posterior aspect of the bone. A small ossicle attached by strong ligaments to this surface gives support to a short phalanx, which articulates with the longer ungueal phalanx.

In the *Ostrich* the number of toes is two only; the *Cassowary* and *Emeu* have each three. The *Apteryx*, and, according to the figures and remains, the *Dodo*, have a fourth. In the *Apteryx* the number of phalanges of the three greater toes follows the ordinary law; the inner toe having three, the middle four, and the outermost five phalanges.

Digestive System.—Though proper salivary glands can hardly be said to exist in birds, they have various glands for secreting a copious supply of mucus for the defence of the tender lining of the mouth and fauces. In the ostrich there are two flattened bodies at the upper and back part of the palate, which may be compared to tonsils. Their surface is covered with innumerable foramina from which a tenacious mucus may be pressed.

The crop in the *Struthionidæ* is of great size. The bulbus glandulosus or proventriculus is situated before the entrance of the œsophagus into the proper stomach, and is so large and so modified in form in some of the species, the ostrich for example, as to give it the appearance of a second stomach; indeed Valisnieri, in his 'Anatomy of the Ostrich,' calls it the first stomach. Mr. Lawrence found the œsophagus of an ostrich which he dissected dilated into an immense bag capable of holding several pints of water, and five or six times larger than the gizzard itself, which was placed on the right and anterior part of this dilatation. The glands did not surround the tube, so that, Mr. Lawrence observes, the term 'zone' would be here inapplicable. They formed, he tells us, a long but narrow band, commencing at the termination of the œsophagus, and running along the front of the bag towards the gizzard. This band measured about twelve inches in length and not more than three at its greatest breadth. The size of the individual glands varied: they were largest in the middle, and decreased towards either margin of the band. Some of them equalled a large pea, and their openings were in proportion. They were arranged in close apposition to each other, and the inner surface of the pouch was covered by a continuation of the insensible lining of the gizzard, which separated very easily from the surface. The cæca in the ostrich are characterized by a remarkable spiral valve, and the villi in its small intestine are rather flat thin laminæ than villi; but they are at the same time long and numerous, presenting a very elegant structure. The large intestine of the ostrich presents a remarkable deviation from the structure usually seen in birds; for the surface of that intestine is in them generally uniform on its surface, whereas in the ostrich the large intestines, which are very long, have numerous transverse folds, like the valvulæ conniventes of man.

In the museum of the Royal College of Surgeons in London, No. 533 of the Physiological Series shows a portion of the gizzard, with the pylorus of the ostrich, exhibiting the valvular structure at that part, adapted to prevent the escape of the contents of the gizzard until they have been sufficiently comminuted, if alimentary, or diminished in size by friction of pebbles, &c. swallowed for the purposes of trituration. No. 533 A is the stomach of an Emeu (*Dromaius Novæ Hollandiæ*) laid open. The gastric glands, of large size, are seen scattered over the whole inner surface of the proventriculus, and terminating towards the gizzard by two oblique lines. Between the proventriculus and gizzard intervenes a considerable space, which may be termed the membranous portion of the stomach, in contradistinction to the muscular part or gizzard. The entrance and outlet of the latter cavity, which are closely approximated in all birds, are here of such large size and so blended together, that the membranous portion of the stomach appears to pass into the intestine by a continuous canal, and the gizzard seems to be simply a lateral dilatation: its parietes are thickest at its commencement; at the remainder they are comparatively weak and thin. A portion of the thick cuticle which lined this cavity is left. A circular valve intervenes between the stomach and duodenum; the latter commences by a considerable dilatation. No. 533 B is the stomach of a Cassowary (*Cassuarius galeatus*) laid open, and constructed on the same type as the preceding. The gastric glands are dispersed over the proventriculus with a similar degree of uniformity; but they are smaller, and their lower boundary is transverse. The cuticular lining being here preserved, shows that the membranous part of the stomach is lined with a thin layer of that substance, which commences just where the glandular part terminates. The gizzard has a similar lateral position, out of the direct passage of the food, as in the Emeu; but is evidently more muscular. Its inner surface is thrown into irregular longitudinal rugæ. The pylorus is protected by a similar circular valve; but the commencement of the duodenum is still more capacious than in the Emeu, reminding one of the pyloric cavity in many of the *Grallatores*. Beyond this dilated part the duodenum presents some transverse rugæ, analagous to valvulæ conniventes. 533 C is the stomach of the Nandu or American Ostrich (*Rhea Americana*, Lath.) laid open. Here a very different type of structure presents itself. The gizzard is more capacious, and, as in the gallinaceous birds, is continued directly from the proventriculus, with the intestine arising near the entry. The parietes of the gizzard, though strongly muscular, are not remarkable for their thickness; the cuticular lining is very thick, and is here well preserved, showing its irregular surface so well adapted for triturating. The gastric glands are more complex than in the preceding preparations, and are aggregated in a mass of a circular form; their orifices are very conspicuous. The pylorus is protected by a projecting valve irregularly ribbed. The duodenum is of moderate width, and has been, here, partially inverted to show the peculiar flocculent character of its lining membrane. 533 D is a longitudinal section of the membranous and muscular parts of the stomach of an ostrich (*Struthio Camelus*, Linn.). The parts have been minutely injected, and the cuticle, which separates very readily after death, has been almost entirely removed, showing the vascular surface beneath. The gizzard, as in the preceding species, is a direct continuation of the membranous part, but its parietes are much thicker. The slit-like form of the pylorus, and its ribbed valve, may be seen on one side of the preparation; and on the opposite side is seen the duodenum laid open to show its villous inner surface.

Sir Everard Home, who presented the preparations above mentioned, thus describes the stomach of the ostrich:—'In the African ostrich the gastric glands are similar in structure to those of the American, only the processes belonging to each gland are much more numerous: they are in general twenty or thereabouts. The cardiac cavity into which they open is not only very large, but is continued down in the abdomen below the liver to a considerable length, and then is bent up to the right side, and is there connected with a gizzard, the digastric muscle of which is as strong as in granivorous birds in general. This gizzard is situated so high up, as to be nearly on a level with the termination of the œsophagus. The cardiac cavity is everywhere lined with a thin cuticle, except where the ducts of the gastric glands open. Their orifices occupy an oval space on the left side, extending from the top to the bottom of the cavity, and about four inches broad. The size of the gizzard is small, when compared to that of the bird. The grinding surfaces do not admit of being separated to any great distance from one another. On one side there are two grooves, and two corresponding ridges on the other. Beyond the cavity of the gizzard is an oval aperture with six ridges, covered with cuticle, which oppose the passage of the contents of the cavity till they are reduced to a small size. In the Cassowaries and American ostrich the stones and other hard bodies which those birds swallow, must, from their weight, force their way into the gizzard, which has a cavity adapted to receive them; but in the African ostrich all such substances must remain in the cardiac cavity, both from its being the most depending part, and from the cavity of the gizzard being too small to admit of their entering it. The cardiac cavity, in the instance which I examined, contained stones of various sizes, pieces of iron, and halfpence; but between the grinding surfaces of the gizzard there were only broken glass-beads of different colours, and hard gravel mixed with food.' (*Lect. on Comp. Anat.*) No. 533 E of the series above noticed is a bottle containing a great quantity of pebbles from an ostrich's gizzard, and No. 533 F is another, containing pebbles and an iron nail, from another gizzard of the same kind. No. 677 to 683 both inclusive are preparations showing the flattened elongated villi, the vascularity of the villous membrane, the veins and arteries and other phenomena of the small intestines of the ostrich.

No. 654 is also a portion of the small intestine of the same bird injected, and showing two processes of peritoneum going off at right angles to the mesenteric process, from the sides of the intestine and trunks of the great vessels. A portion of the peritoneal coat has been removed from one end of this preparation to show the external longitudinal and internal circular layers of the muscular tunic. No. 818 is the pyloric end of the stomach and commencement of the duodenum of an ostrich, showing the entrance of an hepatic duct close to the pylorus, and in a direction inclining to that orifice. The thick cuticle of the gizzard and the valvular structure of the pylorus are also well displayed in this preparation.

The tongue of the *Apteryx* is short; but short as it is, it is more developed than in other Struthious birds. The lining membrane of the *pharynx*, behind the *glottis*, forms two elongate, square-shaped, smooth, thick, and apparently glandular folds or processes, the obtuse free margins of which project backwards like lappels into the *pharynx*; beyond which the lining membrane is produced into close-set, narrow, somewhat wavy, longitudinal folds; the œsophagus is continued through the thorax and diaphragm to the proventriculus without forming any partial dilatation or crop. The *proventriculus* is a narrow elongated cylindrical cavity in the axis of the œsophagus, of which it is an immediate continuation. The gastric glands, narrow elongated follicles, are developed around its whole circumference, and are closely packed together; they are mostly bilobed, but sometimes more subdivided at their cæcal or outer extremities. The longitudinal rugæ of the lining membrane gradually subside at the entry of the proventriculus, where they run into each other, and so form a general reticulate surface, in the meshes of which the orifices of these glands are situated. The epithelium lining the glandular part of the stomach is gradually condensed towards its lower part into a cuticle, which, as it passes into the muscular compartment, assumes a brown colour and a callous hardness, and forms a stratum about one-third of a line thick. In the Cassowary and Emeu, observes Professor Owen in continuation, the proventriculus is marked off from the stomach by a circular strip of *epithelium*, whiter and thinner than the rest, from one to two lines in width, as is well shown in Sir Everard Home's *Comparative Anatomy* (pl. li., lii.). In this structure the Apteryx, though it resembles these species in the arrangement of the gastric glands, does not participate. Its muscular stomach does not present the characteristic subcompressed shape of a gizzard; but in its regular, oval, rounded form resembles the membranous stomach of carnivorous birds. It is small for the size of the bird in its contracted state; but when distended with food, Mr. Owen found that it measured 2½ inches in length, and two inches across at the widest parts. The muscular fibres are not *digastric* and *lateral*, as in the true gizzard; but, instead of being arranged in well-defined masses, radiate from two tendinous oval centres, measuring about two-thirds of an inch in the longest diameter. The pyloric passage is narrow, leading from the left side of the muscular stomach into the *duodenum*. A transverse crescentic ridge of the lining membrane defends the pylorus, but there is no distinct sphincter. The cuticle is continued into the duodenum about three lines beyond the pylorus, but the Professor found no dilatation of this part constituting a pyloric pouch, as in the Emeu and Ostrich. In one Apteryx there was a very short cæcum, the remnant of the ductus vitello-intestinalis, attached to about the middle of the small intestine, and from the same relative position of the intestinal tube in a small female specimen there extended an obliterated duct three lines long, which expanded into a still persistent subglobular vitelline sac, about an inch in diameter, but collapsed, and with wrinkled parietes. In a large male the intestinal canal measured four feet, independently of the cæca, each six inches in length: the rectum was four inches long. The lining membrane of the rectum, which is beset with minute short villi or points, together with glandulæ solitariæ, that become numerous and large at the terminal half of the rectum, is thrown, when it is contracted, into longitudinal folds; but there is no trace of the transverse or spiral valvulæ conniventes, characterising the cæca and rectum of the Ostrich and Rhea: and, in this respect, the Apteryx resembles the Cassowary and Emeu. The liver presented nothing extraordinary. In two of the specimens there was a gall-bladder, as in the Emeu and Cassowary; in the third it was wanting, as is usually the case in the Rhea and Ostrich. In the Apteryx without a gall-bladder there were two long ducts terminating in the same part of the duodenum. The *pancreas* consisted, as usual, of two elongated subtrihedral lobes; and the *spleen* was about the size and form of a hazel-nut.

Circulatory and Respiratory Systems.—In the same series of the museum above noticed, No. 923 exhibits the ventricles of the heart of an ostrich (*Struthio Camelus*) laid open to show the valves at the auricular and arterial orifices. In the right ventricle the auricular orifice is guarded by two valves, as in the crocodile; but the one on the right side is here much the largest, and both valves are muscular. A single artery, the pulmonic, arises from this ventricle, there being no vessel analagous to the visceral or left aorta of reptiles: its orifice is provided with three semilunar valves. The left auricular aperture is provided with two membranous valves, that on the right side of the orifice, which corresponds to the single valve of the crocodile, being the largest. The orifice of the aorta, which is situated directly behind that of the pulmonary artery, and, as it were, on the top of the septum, is provided with three semilunar valves. The muscular parietes of the ventricles are dense and compact; those of the left are of extraordinary thickness: the right ventricle is remarkable for the smoothness and evenness of its inner surface. No. 923 A is a transverse section of the ventricles of the heart of an American ostrich (*Rhea Americana*), showing the relative thickness of their muscular parietes, and their different form, the right appearing to be composed of a partial separation of some of the exterior fibres of the left ventricle. No. 923 B is the heart of an Emeu (*Dromaius Novæ Hollandiæ*) prepared chiefly to show the structure of the auricles. The veins of the body terminate, as in reptiles, by three principal trunks, which, with the coronary vein, unite to form a membranous sinus. Two fleshy semilunar valves are situated at the communication of the sinus with the auricle: they are fixed by their lower extremities to the floor of the auricle, but attached by the opposite ends to strong fleshy columns, which afterwards branch out into the musculi pectinati. The inferior valve is analogous to the Eustachian valve in the heart of Mammalia. The left superior cava opens into the sinus below the orifice of the inferior cava, and a small semilunar fold or valve intervenes between them. Whatever impediment therefore there may be to the free passage of the venous blood through the respiratory system, regurgitation from the auricle to the venous sinus is as carefully guarded against as in the Reptilia. The two pulmonary veins unite, and terminate in a single trunk in the left auricle: a large semilunar fold separates the muscular part of the auricle from the vein. The ventricles are laid open, showing on the right side the two fleshy valves, and on the left the two membranous valves placed at the auriculo-ventricular orifices. Of the great vessels arising from the heart, the left and most anterior is the pulmonary artery; the two next are the left and right *arteriæ innominatæ*, each giving off the carotid and subclavian of its corresponding side; the fourth vessel is the aorta, which winds over the right bronchus, like the right aorta in Reptilia. In the Ostrich the pulmonary cells of the lungs are of large size, as is shown in No. 1127 of the same series.

With reference to this part of the organization, we would call attention to Nos. 1155 and 1156 of that series, the first being a section of the trachea of an Ostrich, showing the rings narrow and entire, as in the rest of the birds, but retaining their cartilaginous texture. One of the longitudinal muscles of the trachea is left attached to this preparation. The second exhibits another section of the same trachea, from which the posterior part of the tube has been removed to show the thinness of the rings and the smoothness of the lining membrane. Both the lateral longitudinal muscles analogous to the *sterno-thyroidei* of Mammalia are preserved: these regulate the length of the air-tube, and accommodate it to the varied and extensive motions of the neck. (*Cat.*, vol. ii.)

In Apteryx the heart is surrounded by a wide and thin pericardium, which is attached to the concave side of the sternum and the margins of the anterior wide fissure of the diaphragm, through which the ventricular portion of the heart protrudes into the abdomen, in the posterior concave interspace of the two great lobes of the liver. Professor Owen remarks, that it requires only that a central *aponeurosis* should have been continued from the anterior margin of the diaphragm, between the heart and liver, to have completely separated from the thorax the proper abdominal

viscera, as in the Mammalia; for the respiratory organs are confined entirely to the thorax. The heart presents the usual ornithic form; but the right auricle appeared, when distended, of uncommon size. The three veins terminated in it in the usual manner; but the inferior cava has a much greater relative capacity than either of the superior cavæ, in consequence of these having to return to the heart little more than the proportion of venous blood brought back by the jugular and internal thoracic veins in other birds. There is no peculiarity of structure in the auricles of the heart; but the resemblance to the Emeu in the disposition of the valves of the right auricle is very close. The posterior valve, which forms part of the boundary of the foramen ovale, seems, Professor Owen observes, to be represented in Mammalia by the muscular ridge called the *annulus ovalis;* the anterior valve is obviously the analogue of the *Eustachian* in man and mammalia generally: the Professor found the principal deviation from the ornithic type of the structure of the heart in the valve at the entry into the right ventricle. This is characterised in birds, generally, by its muscularity and its free semilunar margin; but in the Apteryx it is relatively thinner, in some parts transparent and nearly membranous: a process moreover extends from the middle of its free margin, and is attached by two or three short *chordæ tendineæ* to the angle between the free and fixed *parietes* of the ventricle. In this mode of connection is perceived an approach to the mammalian type of structure analogous to that which the *Ornithorhynchus*, among mammalia, offers, in the structure of the same part to the birds; for, adds Professor Owen, the right auricular ventricular valve in the Ornithorhynchus is partly fleshy and partly membranous. In the left auricle, and in the valves between it and the left ventricle, there was nothing worthy of note; the two membranous flaps were unequal, presenting the usual characteristic of the mitral valve in birds. With regard to the *aorta*, the principal difference observed in the Apteryx was the equality of size in the carotids: in the Emeu, Professor Owen found the right carotid larger than the left. The descending or third primary division of the aorta presents, as in the Emeu and other Struthionidæ, more of the character of the continuation of the main trunk than in other birds, in consequence of its greater size and thicker tunics, relating to the diminished supply of blood transmitted to the rudimental anterior extremities, and the increased quantity required for the powerfully developed legs. 'The aorta,' continues the Professor, 'arches over the right bronchus as usual, and is continued down the thorax to the interspace of the crura of the diaphragm, through which it passes into the abdomen, in a manner remarkably analagous to that which characterises the course of the aorta in the Mammalia. The Apteryx, in fact, seems to be the only bird in which the limits of thoracic and abdominal aorta can be accurately defined; but, in thus establishing this distinction, we observe a remarkable difference from the mammalian arterial system, in the fact that some large and important branches, which in the latter are given off from the abdominal aorta, arise in the present bird above the diaphragm, through which they pass by distinct and proper apertures to the abdominal viscera, which they are destined to supply.'

Professor Owen did not observe any modification of that condition of the venous system which usually characterises the class of birds. The inferior cava did not perforate the diaphragm, but entered the posterior part of the pericardium just above the anterior fissure of the diaphragm, receiving close to its termination the two large hepatic veins. Professor Owen remarks that there exists the same disposition of the renal veins which regulates the quantity of blood transmitted to the lungs or the liver respectively, as in other birds; and that this disposition has been erroneously supposed to indicate that the urine was secreted from the venous blood in birds, as in reptiles and in fishes; but, he observes, the end attained by the venous anastomoses in question bears a much closer relation to the peculiar necessities and habit of life of the bird, and, so far as he knows, has not hitherto been explained.

There was not any trace of the extension of air-cells in the interspaces of the abdominal viscera; and Professor Owen was not less gratified than surprised to find *a complete and well-developed diaphragm* separating the abdominal from the respiratory cavity. This septum did not present any large openings corresponding to those by which the air is continued into the abdomen in the other struthious birds, but was here perforated only for the transmission of the œsophagus and large blood-vessels. 'The diaphragm of the Apteryx,' proceeds the Professor, 'differs from that which characterises the class Mammalia in the following points: first, in the greater relative extent of the anterior or post-sternal interspace; secondly, in the greater proportion of tendinous or aponeurotic tissue, which enters into its composition; thirdly, in being perforated by three different large arteries, and not by the vena cava or splanchnic nerves; and lastly, in the different relative positions of the œsophageal and aortic openings. The plane of the diaphragm is more horizontal, or rather, more parallel with the axis of the trunk, than in the Mammalia generally; but some of the aquatic species, as the *Dugong*, present a position of the diaphragm almost similar to that of the *Apteryx*. The origins of the vertebral or lumbar portion of the diaphragm are by two well-developed crura, which are attached to slight prominences on the sides of the last costal vertebra. These crura are almost entirely tendinous; they expand as they advance forwards, and distribute their aponeurotic fibres in a manner remarkably analogous to the disposition of the fleshy fibres of the lesser muscle of the diaphragm in Mammalia. The mesial fibres decussate in front of the aorta: the lateral ones arch outwards; the rest diverge to constitute the great central tendon. Here they cross each other in various directions, and form distinct and regular decussations around the orifices through which the cœliac artery, with the anterior splanchnic nerve, and the mesenteric artery and nerves, pass into the abdomen; the most noteable decussation is formed by two broad bands immediately behind the large œsophageal aperture, which is separated only by a very narrow transverse chord from the anterior fissure through which the pericardium protrudes and the inferior vena cava passes, the two broad decussating bands expand to form the anterior boundary of the diaphragm, and are inserted into the lateral processes of the sternum. The muscular or costal part of the diaphragm is formed, as in the Ostrich, by a number of separate, broad, and thin fasciculi, which come off from the third, fourth, fifth, sixth, and seventh vertebral ribs, near their junction with the sternal ones. These fasciculi expand, and are gradually lost upon the dorsal surface of the aponeurotic part of the diaphragm, but do not form a conspicuous expanse of muscle, nor constitute the entire thickness or substance of the diaphragm at any point. They are consequently invisible on the abdominal side of the diaphragm, and the aponeurosis of the diaphragm, together with the almost aponeurotic cellular layer of the peritoneum, with which it is continuous, requires to be reflected inwards to bring the digitations representing the great muscle of the diaphragm into view.'

Professor Owen, after adverting to the long recognised existence of a diaphragm in a rudimental condition in birds, and Hunter's beautiful figure of the costal portion of that of the Ostrich (*Cat. Mus. Coll. Chir.*, vol. ii., pl. xxvi., *Physiol. Series*), observes that in this, as well as in the other large Struthious birds, there is also a *pars vertebralis*, or analogue of the lesser muscle of the diaphragm, which rises by two tendinous crura from the last dorsal vertebra, and in the Emeu, by a double origin on each side. Nevertheless, he remarks, their diaphragm is incomplete; first, by reason of an arrest of its centripetal development, which leaves a permanent defect of union in the mesial plane; and, secondly, by the large perforations for the abdominal air-cells.

Professor Owen found the mechanism of respiration in the *Apteryx* essentially the same as in other birds, and he states that a more muscular diaphragm than it possesses would be unnecessary as a part of the mechanism. As in the Mammalia, the abdominal surface of the diaphragm is principally in contact with the liver, spleen, and stomach, but its thoracic surface does not support the heart, and it is separated from the lungs by the interposition of a series of small but well-marked air-cells. No thoracic serous sac or pleura could be traced. 'Thus,' says Professor Owen, 'although the respiratory organs are confined to the chest, and the Apteryx offers the only known instance in the feathered race of a species in which the receptacular part of the lungs is not continued into the abdomen, yet the Struthious type is strictly preserved, and the march of development has only been restricted, not changed.'

Brain, Nervous System, and Senses.—The brain and nervous system appear to be, generally speaking, well developed in the Struthious birds. No. 1322 and No. 1323

in the Physiological Series of the *Mus. Coll. Chir.*, exhibit the brain of an Ostrich minutely injected, and the section of the cerebellum removed from the brain. Nos. 1352 to 1357, both inclusive, are preparations of the spinal chord of the same bird. The original description of No. 1355, which shows the sacral and caudal portions, is as follows:—'The part of the medulla which lies in the loins and tail of an Ostrich. That part which lies in the loins is considerably larger than those which belonged to the neck and back: and then it becomes pretty fast smaller to the tail. This swelling in the loins is owing perhaps to this bird having such large thighs and legs: and when we consider that this bird, having such small wings, must have the whole progressive motion performed by the legs, and the legs are therefore longer in proportion to the size of the bird than in birds in common, we must see why the medulla ought to be large at this part in this bird.'

Touch.—No. 1401 of the same series is a strip of cutis from the foot of the Ostrich, showing the papillæ or coarse villi on that part: they are very closely set, and about a quarter of an inch in length, placed parallel to one another, and perpendicular to the surface which is applied to the soil in walking.

Taste tolerably well developed. Nos. 1474 to 1476, both inclusive, show the tongue, &c. of certain Struthionidæ. The two first exhibit those parts in the Ostrich; No. 1475 is the tongue, os hyoides, and larynx of a Rhea, in which bird the tongue is relatively larger than in the Ostrich, which has that organ of so small a size that it has been taken for an epiglottis. The tongue of the Rhea is studded over with minute black specks, which are the orifices of muciparous glands. In No. 1476, showing the same parts in a Cassowary (*Cassuarius galeatus*), the tongue is seen to be thin, flat, and serrate on the edges.

Smell.—The olfactory system is well developed in the Struthionidæ. In the Apteryx it appears to be altogether larger than in other birds. Professor Owen observes that the nocturnal habits of the Apteryx, combined with the necessity for a highly developed organ of smell, which chiefly compensates for the low condition of the organ of vision, produce the most singular modifications which the skull presents, and, he adds, that we may say that those cavities which in other birds are devoted to the lodgement of the eyes, are, in the Apteryx, almost exclusively occupied by the nose.

Sight.—The eye is well formed, and the sight piercing in the Struthionidæ generally; but, in the Apteryx, the eye has less development than appears in the rest of the family, the reasons for which are above assigned. It presents a remarkable deviation from the construction characteristic of birds generally, in the total absence of the *pecten* or *marsupium*, a privation compatible with the nocturnal habits and restricted locomotion of this species. 'The eyeball,' says Professor Owen, 'is relatively much smaller than in other birds; its antero-posterior diameter is three lines; its transverse diameter four lines. The cornea transparens is very convex, and two lines in diameter. The sclerotic is thin, but the margin supporting the cornea is strengthened by a circle of small osseous plates. The choroid is a delicate membrane; its pigment is of a light brown colour. The ciliary processes commence at the ciliary ring, each process having at its origin a slight linear rising, which becomes gradually wavy and tortuous as it approaches the lens, anterior to the circumference of which it projects freely to a small extent. The iris in the specimen examined was one-third of a line in breadth. The optic nerve terminates by a small round aperture. The lens is two lines in breadth, and nearly one line at the thickest part, being thus more convex than in other birds. The external appendages of the eye presented no peculiarities, except the very great strength of the orbicularis palpebrarum: the membrana nictitans had the usual trochlear muscles: its free margin was black.'

Hearing.—This sense appears to exist in considerable perfection in the Struthious birds.

Renal and Genital System.—No. 1195 of the Physiological Series in the museum of the Royal College of Surgeons presents the kidneys of an ostrich, of an elongated flattened form and lobulated, but with the divisions not extending so deeply into the glandular substance as in most other birds: the anterior lobe, which is the largest, is nevertheless completely separated from the rest. The substance of the different lobes has a convoluted disposition like that of the reptiles, but is more compact. The renal arteries sent off from the aorta are shown on one side, and the corresponding veins joining the inferior cava on the opposite, where also the testes and supra-renal glands are seen: bristles are placed in the ureters. No. 2456 shows the testicles of a cassowary (*Cassuarius galeatus*) of a more elongated form than in the fowl. They are relatively small, the bird having died before the season of sexual excitement. No. 2468 is the penis of an Emeu (*Dromaius Nov. Holl.*), resembling in structure that of the anserine birds: the elastic ligamentous substance which enters into its composition is also disposed so as to retract it into a spiral figure. 2469 is the penis of an Ostrich injected, showing the two fibro-cartilaginous substances, commencing by separate crura, and forming the principal part of the body of the penis, between which and along the upper surface of the penis is continued the groove representing the urethra; the true corpus cavernosum is situated on each side of this groove; the part which is reflected back from the extremity of the penis, and seems to represent the glans, consists of the elastic ligament which effects the retraction of the penis. At the commencement of the urethral groove the papillæ are preserved, on which the vasa deferentia terminate: bristles are passed through these papillæ. No. 2470 is a transverse section of the injected corpus cavernosum from the same penis. The Ostrich from which the present and preceding preparation were taken stood eleven feet high. (*Cat. Mus. Coll. Chir.*) The penis is exposed and the groove exhibited when the bird discharges its urine. No. 2734 shows the cloaca and termination of the oviduct, ureters, and rectum, with the urinary bladder and clitoris of an Ostrich. (*Catalogue.*)

The kidneys of the Apteryx are situated symmetrically, and lodged, as in other birds, in the irregular hollows of the back part of the cavity of the pelvis. Each kidney is divided into five lobes by oblique fissures extending into the posterior surface of the gland: the middle lobe is the largest. The lobes appear to have a compact and even surface, but their cerebriform convolutions can, Professor Owen states, be readily unravelled. The tortuous ureter emerges from the inner side of the posterior extremity of the kidney, and, after a course of an inch and a half, terminates in the upper and back part of the uro-genital cavity. The oval and yellow supra-renal bodies were of homogeneous texture, each three lines in length, and adhering closely to the vena cava. The testes were of a subcompressed oval figure. The vasa deferentia are formed by the union of numerous most minute efferent tubules, which pass from the testes, without forming an epididymis, into a soft amorphous substance of a grey colour, which lies between the testes and the bright yellow supra-renal body. The vas deferens formed by the greater part of the tubules perforates the corpus Wolffianum. The penis, which projects from below the external orifice of the urethro-sexual cavity into the vestibular or outer compartment of the cloaca, rapidly diminishes to a point, and its extremity is spirally retracted. An urethral or rather seminal groove traverses the upper, or what, if the penis were drawn out of the cloaca and bent forwards along the abdomen, would be its under surface, and is continued to the end of its spiral extremity: the margins of the groove are not beset with papillæ, but simply wrinkled transversely, as in the Emeu and Ostrich. Immediately above the base of the penis there is, on each side, a considerable plexus of arteries and veins, over the base of which plexus muscles cross, which would, Professor Owen thinks, impede, if not arrest, the current of the blood in the veins, and he observes that they might be termed *compressores venarum penis*, as they fulfil the same office as the *compressores* described by Douglas in the dog. Nothing deserving particular remark appears to have been observed in the female organs, though the careful statement of the detail in Professor Owen's paper well deserves the student's attention.

The myology of *Apteryx* by that author is now before the Zoological Society of London, and we understand that the neurology of the bird by the same hand is also to be laid before that Society.

Systematic Arrangement and Natural History.

The place assigned to the Struthious birds by zoologists generally will be found in the articles Birds and Grallæ. Mr. Vigors observes that those species of Tetraonidæ which exhibit a weakness or a deficiency in the hinder toe lead us at once to the three-toed groups of the *Struthionidæ*,

with the bills of which, more particularly that of *Rhea*, those of some species of *Tinamus* correspond. Mr. Vigors includes in the family the *Brevipennes* of Cuvier, together with the genus *Otis* [BUSTARD] of Linnæus, which Mr. Vigors observes evidently agrees with them in their principal characters. It corresponds also, he adds, with the order *Cursores* of Temminck, with the exception of the genus *Cursorius*, Lath., which, he thinks, possesses more of the characters of the *Wading* than of the *Gallinaceous* order; but with which, he remarks, the present family will still be found to preserve its affinity by means of the circular disposition which, he conceives, is seen to prevail throughout the divisions of ornithology. The chief genera comprised in the *Struthionidæ* are the *Rhea*, which, in Mr. Vigors's opinion, unites this family with the last; *Struthio*, Linn., which having but two toes, and thus carrying the character of the group to the extreme, may be considered the type; *Casuarius*, Brisson; *Dromiceius*, Vieill.; *Otis*, Linn.; and *Didus*, supposed to be extinct. [DODO.] In this arrangement the *Struthionidæ* stand between the *Tetraonidæ* and the *Cracidæ* in the order RASORES. *Apteryx* was not sufficiently known when Mr. Vigors wrote. Mr. Swainson arranges the family in the same order between the *Tetraonidæ* and the COLUMBIDÆ, and he comprises under the *Struthionidæ* the genera *Otis* and *Struthio*, the latter comprehending the subgenera *Casuarius*, *Dromiceius*, *Apternyx* (Apteryx), and *Rhea*. From this family Mr. Swainson entirely excludes the *Dodo*, which was, in his opinion, the rasorial type of the *Vulturidæ*.

Mr. G. R. Gray makes the *Struthionidæ* the first family of the order *Cursores*, Temm., the sixth order in Mr. Gray's arrangement, and includes under it the following subfamilies and genera:—

Subfam. 1. Struthioninæ.

Genera.—*Struthio*, Linn.; *Casuarius*, Briss.; *Dromaius*, Vieill.; and *Rhea*, Briss.

Subfam. 2. Apteryginæ.

Genus.—*Apteryx*, Shaw.

? Subfam. 3. Didinæ.

Genus.—*Didus*, Linn.

Subfam. 4. Otinæ.

Genera.—*Otis*, Linn.; *Tetrax*, Leach; *Sypheotides*, Less.; *Chlamydotis*, Less.; and *Eupodotis*, Less.

The *Struthionidæ* are placed in Mr. Gray's arrangement between the *Tinamidæ*, the last family of his *Rasores*, and the *Charadriadæ* [PLOVERS], the first family of his *Grallatores*.

Amongst the *Mammalia* the MARSUPIALIA make the nearest approximation to the *Ovipara*; and amongst the birds the *Struthionidæ* approach the most closely to the *Mammals* and the *Reptiles*.

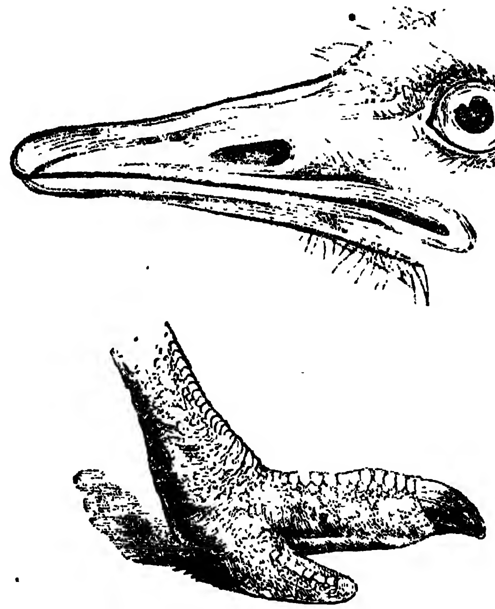
This approximation of the Struthious birds to the *Mammalia* especially cannot fail to strike the physiologist. In the first and typical genus, *Struthio*, it is strongly manifested.

STRUTHIONIDÆ OF THE OLD WORLD.

Struthio. (Linn.)

Generic Character.—*Bill* moderate, obtuse, straight, depressed at the point, which is rounded and unguiculate; mandibles equal and flexible; nasal fossæ longitudinal, prolonged half way down the bill, open. *Feet* very robust; toes two only, stout and strong, directed forwards, and connected at their base by a strong membrane, the internal toe considerably larger than the external, and furnished with a thick and hoof-like claw, external toe clawless. Wings useless for flight, furnished with long soft undulating plumes, and armed with two spurs, or rather two plumeless shafts, not unlike a porcupine's quill. *Head* and upper half of the neck scantily covered with a thin down, through which the colour of the skin is visible.

It would be a needless occupation of space to give a minute description, which is so well known in these days of zoological societies and menageries. The Ostrich is generally understood to be the bird designated by the terms *Jonah* or *Jaanah* and *Rinonim*, in the Scriptures (*Levit.*, xi. 19; *Deut.*, xiv. 15; *Job*, xxx. 29; *Isai.*, xiii. 21; xxxiv. 13; xliii. 20; *Jer.*, l. 39; *Lament.*, iv. 3; *Mic.*, i. 8; *Job*, xxxix. 13). In many of these passages, *Jer.*, l. 39, and *Isai.*, for instance, our version reads 'Owls,' and in *Levit.* does not mention the Ostrich, but the general opinion seems to be in favour of the Ostrich being intended. It is the *Neamah* of the Arabs, *Thar edsjammel* (Camel-bird) of the Orientals, Στρουθοκάμηλος (Struthocamelos) of the Greeks, *Struthiocamelus* of Pliny and the antient Italians, *Struzzo* and *Struzzolo* of the modern Italians, *Strauss* of the Germans, *Autruche* of the French, and *Struthio Camelus* of Linnæus.



Head and Foot of Ostrich.

Food, Habits, &c.—The approximation in the digestive organs of the ostrich to the structure of some of these parts in the Ruminantia, especially in the additional ventricle of the bird, is still further strengthened by the bisulcous foot, which may not be inaptly compared to that of the camel, and probably led in no small degree to its appellation of Camel-Bird, to which, moreover, its height, lengthened neck, habit of frequenting the desert, and patience under thirst may have contributed.

The food of the ostrich consists of vegetable substances only, but seeds and grain appear to be preferred, and it is consequently a most unwelcome neighbour to the cultivator of the soil, on whose crops the bird commits great devastation. Its iron-eating propensities have long been celebrated, and indeed it picks up and swallows any mineral substance, metallic or not, with indiscriminating voracity. Nor is this propensity confined to the devouring of minerals; for leather, hair, cordage, and wood do not seem to come amiss. In the stomach of one of those birds Valisnieri found a farrago of grass, nuts, cords, stones, glass, brass, iron, tin, copper, lead, wood, and among the stones one weighing more than a pound.

Perrault took from an ostrich's stomach seventy *doubles*, the greater part of which were worn down three-fourths of their substance by collision against each other or the pebbles found with them: those which were bent were worn and polished on the convex side, while they remained entire on the concave surface. These copper pieces had tinged everything in the stomach with green. This eagerness for picking up everything, whether or not it can be assimilated or can assist in the grinding down of the food by the action of the stomach, to which no doubt the polishing and wasting of the pieces of money mentioned by Perrault were due, is often fatal to the ostrich. Too great a quantity of copper or iron thus taken into the stomach has caused the death of the bird. Valisnieri saw one killed by swallowing a quantity of quick-lime; and one kept in the Gardens of the Zoological Society of London was first deformed and afterwards died from swallowing part of a parasol. Some of the heterogeneous contents found in the stomachs of these birds are preserved in the Museum of the Royal College of Surgeons (*ante*, p. 137).[1]

Their speed is great. The swiftest greyhound cannot overtake them; and even the Arabian and his horse are obliged to have recourse to cunning as well as speed to close the chase, by throwing a stick dexterously between its legs, or otherwise to disable it. In its flight it spurns the pebbles behind it like shot against the pursuer. Nor is this its only mode of annoyance. Dr. Shaw, who gives a pretty

account of the airs which the ostrich plays off in a domesticated state, fanning itself with its expanded wings, and seeming to admire its own shadow, states, that though tame and tractable to those familiar with them, these birds were often very fierce to strangers, especially those of the poorer sort, whom they would try to run down and attack with their feet. They are capable of striking with great force, and the same author gives a melancholy account of a person whose belly was ripped up by a stroke from the pointed and angular claw. The European sportsman, after riding so that the bird shall pass within shot, dismounts and brings it down with the rifle.

The strength of the ostrich is great. Adanson mentions the rapidity with which a large tame one ran, first under the weight of two little blacks, and afterwards under two full-grown negroes, while a smaller bird carried with equal facility one full-grown negro.

The general opinion is that the ostrich is not polygamous: *quære tamen.* The number of eggs does not seem to be correctly ascertained. From twenty to thirty, and thirty-eight with thirteen others scattered around the inartificial nest—a mere pit in the sand, which is thrown up so as to form an elevated edge round it, about three feet in diameter—have been found together. Some have made the number eighty; others reduce it to ten. This is the number that Le Vaillant would assign to a single female, although he disturbed one from the nest containing the thirty-eight eggs surrounded by the thirteen others. This nest he watched, and saw during the day four females successively sit upon them; and towards the close of the evening a male took his turn of incubation. This then was probably a common nest in which several females had laid their eggs.

The passage in *Job* (xxxix. 14) will occur to every one, and there is no doubt that within the torrid zone the heat of the sun's rays renders the incubation of the female unnecessary, excepting perhaps at night; but in cooler latitudes she performs the maternal office with assiduity, and even in the warmer climates, where an officious determination to sit would in all probability endanger the vitality of the eggs, she watches over them; and indeed the hunters have learned from her actions, and doubling back in her flight to one particular spot, where to seek for the nest. If, as has been asserted, the outlying eggs are intended to serve for the nourishment of the young, it is a proof of provident care for her offspring on the part of the mother.

Utility to Man.—The flesh of the ostrich when young is good and palatable, and the eggs are considered a great delicacy. Both Europeans and natives agree in this last opinion. The Hottentot, who abstracts the egg from the nest with a long stick, that the hen may not take alarm at the human touch, and not abandon the nest, but go on laying, as the common hen will do to a great extent when her nest is robbed, buries them in hot ashes. They are said to be excellent when eaten with a sufficient quantity of butter. The brains of hundreds of these birds not unfrequently made a dish at the insane Roman suppers; and Firmius is said to have eaten a whole ostrich at a meal. The flesh of the bird was prohibited by the Mosaical law as unclean, and the Arabs regard it in the same light; but many of the barbarous tribes of the interior of Africa feed on it without scruple. The well-known plumes form a material article of commerce for the head-dress of European ladies, &c.

There is in the noble and admirably arranged zoological gallery of the British Museum a fine and well-preserved series of young ostriches. Not the slightest trace of a nail is observable on the external toe of any of them, any more than on that of the adult bird. The usual height of the ostrich is from seven to eight feet, but it has reached to eleven feet (*ante*, p. 140).

Geographical Distribution.—Africa. Scarcely known beyond the limits of the Arabian deserts.

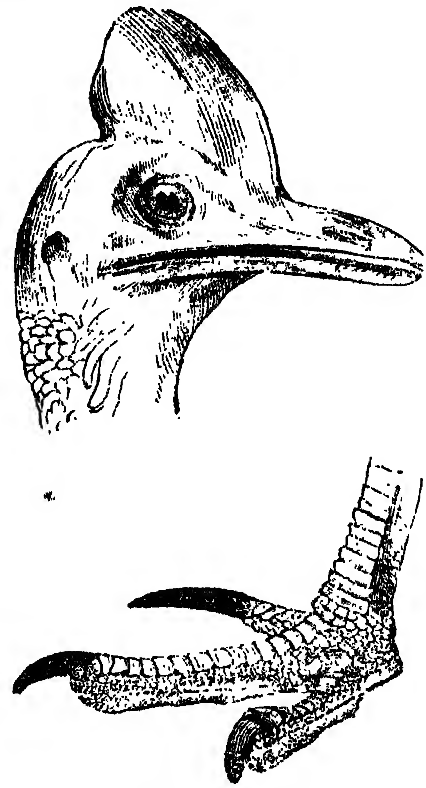
Casuarius. (Briss.)

Generic Character.—*Bill* straight, carinated above, rounded and bent at the point; upper mandible slightly vaulted, the edges depressed, and notched or jagged towards the extremity; the lower mandible rather angular below towards the point; nasal fossæ nearly as long as the bill. *Head* helmeted. Front of the *neck* naked, and furnished with two wattles. *Toes* three. Wings entirely unfit for flight, furnished with five round naked pointed quills.

Example. *Casuarius Emeu.*

Description.—Bill compressed laterally, the head surmounted with a bony prominence covered with a horny substance; skin of the head and the upper part of the neck naked, tinged with cerulean blue and flame-colour, with pendent wattles like those of a turkey-cock; wings furnished with some stiff featherless quills; nail of the internal toe much the strongest. 'It is,' says Cuvier in continuation, 'the largest of the birds after the ostrich,* from which it differs sufficiently in its anatomy, for it has short intestines and small cæca, wants the intermediate stomach between the crop and the gizzard, and its cloaca does not exceed that of other birds in proportion.

This well-known bird was named *Emeu* by the early Portuguese navigators. It is the *Emeu* vulgo *Casoaris* (the latter appearing to be the Malayan appellation) of Bontius, the *Struthio Casuarius* of Linnæus, *Casuarius galeatus* of Vieillot, and *Cassowary* of the British naturalists, who now apply the term *Emeu* to the New Holland Cassowary (Dromaius, Vieill.). Its height when erect is about five feet.



Head and Foot of Cassowary.

Geographical Distribution.—The peninsula of Malacca and the great chain of islands to the south and east. Bontius notes it from Ceram and the other neighbouring Molucca Islands. M. Lesson observes that it is very common in the islands of the Asiatic Archipelago, and especially at New Guinea. It is frequently seen alive in our menageries, and is common in museums.

Food, Habits, &c.—This species, which is characterised by M. Lesson as 'stupid and massive,' feeds on seeds and herbage according to him; but Cuvier says that it eats fruits and eggs, but no grain. Bontius states that he does not think it should be placed among the birds: 'Alæ enim ad currendum pro velo, non ad velandum inserviunt.' He adds, that when irritated, it does not rush forward to the attack, but turns itself obliquely, kicking backwards at the enemy. Cuvier observes that the featherless quills serve the bird for offensive weapons. Bontius remarks that the eggs are very different from those of the ostrich, by reason of their thinness and colour, for their shell is greenish, ornamented with numerous tubercles of a deeper green (saturè viridibus): he adds that they are eaten by the natives. Cuvier relates that the bird lays a small number of green eggs, which it abandons, like the ostrich, to the heat of the climate.

Didus. [Dodo.]

By the kindness of Professor Owen, we are enabled to give the following interesting additions to the evidences of the existence of this interesting form:—

* But see post, p. 145.

'Whilst at the Hague,' writes the Professor to Mr. Broderip, 'in the summer of 1838, I was much struck with the minuteness and accuracy with which the exotic species of animals had been painted by Savery and Breughel in such subjects as Paradise, Orpheus charming the Beasts, &c., in which scope was allowed for grouping together a great variety of animals. Understanding that the celebrated menagerie of Prince Maurice had afforded the living models to these artists, I sat down one day before Savery's Orpheus and the Beasts, to make a list of the species which the picture sufficiently evinced that the artist had had the opportunity to study alive. Judge of my surprise and pleasure in detecting in a dark corner of the picture (which is badly hung between two windows) the *Dodo*, beautifully finished, showing for example, though but three inches long, the auricular circle of feathers, the scutation of the tarsi, and the loose structure of the caudal plumes. In the number and proportions of the toes, and in general form, it accords with Edwards's oil painting in the British Museum; and I conclude that the miniature must have been copied from the study of a living bird, which it is most probable formed part of the Mauritian menagerie.

'The bird is standing in profile, with a lizard at its feet. Not any of the Dutch naturalists to whom I applied for information respecting the picture, the artist, and his subjects, seemed to be aware of the existence of this evidence of the Dodo in the Hague collection.

'I think I told you that my friend Professor Eschricht of Copenhagen had written to inform me that the *skull of a Dodo* had been lately discovered in the museum at Copenhagen: it had before formed part of the museum of the Duke of Gottorp.'

American Struthionidæ.

Rhea. (Briss.)

Generic Character.—*Bill* straight, short, rather soft, furnished at its base with an obliterated membrane, slightly depressed, moderate, the point rounded, beak and unguiculated; upper mandible with its back elevated, notched towards the end; lower mandible flat below; nostrils large, longitudinal. *Wings* improper for flight, the phalanges furnished with plumes and terminated by a spur. *Head* completely feathered. *Feet* three-toed, all the toes furnished with claws.

Foot of Rhea.

In this genus the wing is better developed than in any of the Struthious birds, but it is still useless as an organ of flight.

Till lately the only species known was *Rhea Americana*, the *Nhandu-Guaçu* of the Brazilians. (Marcgrave: Piso.) It is described as haunting the banks of rivers and having the same propensity for swallowing iron and stones as the African ostrich, running so swiftly and cunningly, aided by its wings, as not only to evade the pursuit of dogs, but the weapons of the barbarians. The females are said to lay eggs like other ostriches, but smaller, in the sand; and it is added that the males sedulously perform the function of incubation: 'Salaces sunt admodum, mentulamque aliquantum aduncam vibrant sæpe, donec reperta femella eam rigidissimè ineant, suppressamque diu immobilem teneant.' (Piso.) The same author states that these American ostriches are fond of flesh, the best fruits, and the little fishes washed to the bank; nor do they spare the grey amber, if they can gain possession of it on the shore. He adds that their flesh is approved of and solid, equalling that of our swans and geese.

This American ostrich is the *Struthio Rhea* of Linnæus, the *Tuiju* of Lacépède; but we owe the perfect knowledge of a second species to Mr. Darwin, who has given a figure and ample descriptions of the bird and its habits in the 'Zoology of the Beagle,' and in his 'Researches in Zoology and Natural History;' but before we proceed to notice *Rhea Darwinii*, we must give his valuable account of the habits of *Rhea Americana*.

'This bird,' says Mr. Darwin, 'is well known to abound on the plains of La Plata. To the north it is found, according to Azara, in Paraguay, where however it is not common; to the south its limit appears to be from 42° to 43°. It has not crossed the Cordillera; but I have seen it within the first range of mountains on the Uspallata plain, elevated between six and seven thousand feet. The ordinary habits of the ostrich are well known. They feed on vegetable matter, such as roots and grass; but at Bahia Blanca I have repeatedly seen three or four come down at low-water to the extensive mud-banks, which are then dry, for the sake, as the Gauchos say, of catching small fish. Although the ostrich in its habits is so shy, wary, and solitary, and although so fleet in its pace, it falls a prey, without much difficulty, to the Indian or Gaucho armed with the bolas. When several horsemen appear in a semicircle, it becomes confounded, and does not know which way to escape. They generally prefer running against the wind; yet at the first start they expand their wings, and, like a vessel, make all sail. On one fine hot day I saw several ostriches enter a bed of tall rushes, where they squatted concealed till quite closely approached. It is not generally known that ostriches readily take to the water. Mr. King informs me that in Patagonia, at the bay of St. Blas and at Port Valdes, he saw these birds swimming several times from island to island. They ran into the water, both when driven down to a point, and likewise of their own accord, when not frightened: the distance crossed was about two hundred yards. When swimming, very little of their bodies appears above water, and their necks are extended a little forward: their progress is slow. On two occasions I saw some ostriches swimming across the Santa Cruz river, where it was about four hundred yards wide, and the stream rapid.

'The inhabitants who live in the country readily distinguish, even at a distance, the male bird from the female. The former is larger and darker coloured, and has a longer head. The ostrich, I believe the cock, emits a singular deep-toned hissing note. When first I heard it, standing in the midst of some sand-hillocks, I thought it was made by some wild beast, for it is a sound that one cannot tell whence it comes or from how far distant. When we were at Bahia Blanca in the months of September and October, the eggs were found, in extraordinary numbers, all over the country. They either lie scattered single, in which case they are never hatched, and are called by the Spaniards huachos, or they are collected together into a shallow excavation which forms the nest. Out of the four nests which I saw, three contained twenty-two eggs each, and the fourth twenty-seven. In one day's hunting on horseback, sixty-four eggs were found; forty-four of these were in two nests, and the remaining twenty scattered huachos. The Gauchos unanimously affirm, and there is no reason to doubt their statement, that the male bird alone hatches the eggs, and for some time afterwards accompanies the young. The cock when on the nest lies very close; I have myself almost ridden over one. It is asserted that at such times they are occasionally fierce, and even dangerous, and that they have been known to attack a man on horseback, trying to kick and leap on him. My informer pointed out to me an old man, whom he had seen much terrified by one chasing him.'

Mr. Darwin, after having referred to the passage in Burchell's 'Travels in South Africa,' in which that traveller remarks, that having killed a male ostrich with dirty feathers, it was said by the Hottentots to be a nest bird, and referring to the male emu's habit of taking care of the nest, proceeds as follows:—

'The Gauchos unanimously affirm that several females lay in one nest. I have been positively told that four or five hen birds have been actually watched and seen to go, in the middle of the day, one after the other, to the same nest. Although this habit at first appears very strange, I think the cause may be explained in a simple manner. The number of eggs in the nest varies from twenty to forty, and even to fifty; and, according to Azara, seventy or eighty. Now, although it is most probable, from the number of eggs found in one district being so extraordinarily great in proportion to that of the parent birds, and

likewise from the state of the ovarium of the hen, that she may in the course of the season lay a great number, yet the time required must be very long. Azara states that a female, in a state of domestication, laid seventeen eggs, each at the interval of three days, one from another. If the hen were obliged to hatch her own eggs, before the last was laid the first probably would be addled; but if hens, as is stated to be the case, combined together, then the eggs in one collection would be nearly of the same age. If the number of eggs in one of these nests is, as I believe, not greater, on an average, than the number laid by one female in the season, then there must be as many nests as females, and each cock-bird will have its fair share of incubation; and this during a period when the females probably could not sit, on account of not having finished laying.* I have before mentioned the great numbers of huachos, or scattered eggs; so that in one day's hunting the third part found were in this state. It appears odd that so many should be wasted. Does it not arise from some difficulty in several females associating together, and in finding a male ready to undertake the office of incubation? It is evident that there must at first be some degree of association between at least two females, otherwise the eggs would remain scattered at distances far too great to allow of the male collecting them into one nest. Some authors believe that the scattered eggs are deposited for the young birds to feed on. This can hardly be the case in America, because the huachos, although often addled and putrid, are generally whole.'

Variety of Rhea Americana.—It would appear that there is a white or albino variety of this species, for a Gaucho told Mr. Darwin that he had once seen a snow-white one, and that it was a most beautiful bird.

Rhea Darwinii was described by Mr. Gould, at a meeting of the Zoological Society of London. It is smaller, and the general tinge of the plumage is light-brown in place of grey; each feather being conspicuously tipped with white. The bill is considerably smaller, and, especially, less broad at its base; the culmen is less than half as wide, and becomes slightly broader towards the apex, whereas in the *R. Americana* it becomes slightly narrower: the extremity of both the upper and the lower mandible is more tumid in the latter than in *R. Darwinii*, and there are other differences.

Rhea Da

The first notice Mr. Darwin received of this species was at the Rio Negro, in Northern Patagonia, where he repeatedly heard the Gauchos talking of a very rare bird, called *Avestruz Petise*. They described it as being less than their common ostrich, which is there abundant, and with differences of colour, and said that it was more easily caught by the bolas than the other species. The eggs of the small species appeared more generally known, and it was remarked, with surprise, that they were very little less than those of the common *Rhea*, but of a slightly distinct form, and with a tinge of pale blue. Some eggs that Mr. Darwin picked up on the plains of Patagonia agreed pretty well with this description, and he doubted not that they were those of the *Petise*. He states that this species occurs most rarely in the neighbourhood of the Rio Negro; but that about a degree and a half farther south they are tolerably abundant. One Gaucho however told him that he recollected having seen one, many years before, near the mouth of the Rio Colorado, which is north of the Rio Negro. They are said to prefer the plains near the sea. Mr. Darwin goes on to state, that when at Port Desire, in Patagonia (lat. 48°), Mr. Martens shot an ostrich. Mr. Darwin looked at it, and forgetting at the moment the subject of the Petises, thought it was a two-third grown one of the common sort. The bird was skinned and cooked before Mr. Darwin's memory returned: but the head, neck, legs, wings, many of the larger feathers, and a large part of the skin had been preserved. This constitutes the specimen in the museum of the Zoological Society.

'Among the Patagonian Indians in the Strait of Magellan,' says Mr. Darwin in continuation, 'we found a half-bred Indian, who had lived some years with this tribe, but had been born in the northern provinces. I asked him if he had ever heard of the Avestruz Petise. He answered by saying, 'Why there are none others in these southern countries.' He informed me that the number of eggs in the nest of the Petise is considerably less than with the other kind, namely, not more than fifteen on an average; but he asserted that more than one female deposited them. At Santa Cruz we saw several of these birds. They were exceedingly wary: I think they could see a person approaching, when he was so far off as not to distinguish an ostrich. In ascending the river, few were seen; but in our quiet and rapid descent, many, in pairs, and by fours or fives, were observed. It was remarked by some of the officers, and I think with truth, that this bird did not expand its wings, when first starting at full speed, after the manner of the northern kind. The fact of these ostriches swimming across the river has been mentioned.'

In conclusion, Mr. Darwin remarks, that *R. Americana* inhabits the eastern plains of South America as far as a little south of the Rio Negro (lat. 41°), and that *R. Darwinii* takes its place in Southern Patagonia; the part about Rio Negro being neutral ground.

We have said that we owe the perfect knowledge of this smaller species to Mr. Darwin. There is no doubt that others have seen it. Dobrizhoffer (1749) clearly was aware of its existence. In his account of the Abipones, he says, 'You must know moreover that Emus differ in size and habits in different tracts of land; for those that inhabit the plains of Buenos Ayres and Tucuman are larger, and have black, white, and grey feathers; those near to the Strait of Magellan are smaller and more beautiful, for their white feathers are tipped with black at the extremity, and their black ones in like manner terminate in white.' Those ostriches which Wallis saw at Batchelor's river (lat. 53° 54′) in the Strait of Magalhaens, were doubtless Petises. Mr. Darwin notices these instances, and further remarks that the distinguished French naturalist M. A. D'Orbigny, when at Rio Janeiro, made great exertions to procure this bird, but did not succeed. 'He mentions it,' says Mr. Darwin, 'in his "Travels" (vol. ii., p. 76), and proposes (in case, I presume, of his obtaining a specimen at some future time, and thus being able to characterize it) to call it *Rhea pennata*.' Now Mr. Gould has characterized it from the specimen brought home by Mr. Darwin (1837), who liberally presented his valuable zoological collection to the Zoological Society of London, and has given the interesting account of its habits and geographical distribution above quoted. Mr. Gould's name therefore must have the preference.

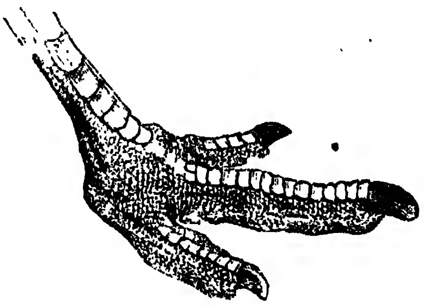
* Lichtenstein however ('Travels,' vol. ii., p. 25) states that the hens begin to sit when ten or twelve eggs are laid, and that they afterwards continue laying. He affirms that by day the hens take turns in sitting, but the cock sits all night.

Rhea Americana has been exhibited alive in the Gardens of the Zoological Society of London, and specimens of both species are, we believe, to be seen in the museum of that Society and in the British Museum.

AUSTRALIAN AND NEW ZEALAND STRUTHIONIDÆ.

DROMAIUS. (Vieill.)

Generic Character.—*Bill* straight, with the edges very much depressed, rounded at the extremity, slightly carinated above. *Nostrils* large, protected by a membrane and opening above about the middle of the bill. *Head* feathered. *Throat* nearly naked. *Feet* three-toed



Foot of Emeu.

This is also the genus *Dromiceius* of Vieillot, *Tachea*, Flem., and the form is placed by Latham under the genus *Casuarius*, and by Temminck under *Rhea*.

The *Emeu, Emu*, or *New Holland Cassowary, Dromaius Novæ Hollandiæ* of authors, *D. ater* of Vieillot, and *Dromiceius Australis* of Swainson, *Parembang* of the natives, has become quite familiar to us from the frequency of its exhibition in menageries, and its breeding so readily in a state of domestication. The following is Mr. Bennett's description of this species:—'In size and bulk the *Emeu* is exceeded by the African Ostrich alone. It is stated by travellers to attain a height of more than seven feet, and its average measurement in captivity may be estimated at between five and six. In form it closely resembles the ostrich, but is lower on the legs, shorter in the neck, and of a more thickset and clumsy make. At a distance its feathers have more of the appearance of hair than of plumage, their barbs being all loose and separate. As in the other ostriches, they take their origin by pairs from the same shaft.* Their general colour is a dull brown, mottled with dirty grey, the latter prevailing more particularly on the under surface of the bird. On the head and neck they become gradually shorter, assume still more completely the appearance of hairs, and are so thinly scattered over the forepart of the throat and around the ears, that the skin, which is of a purplish hue, is distinctly visible.' This appearance is most remarkable in the older birds, in which these parts are left nearly bare. The wings are so extremely small as to be quite invisible when applied to the surface of the body. They are clothed with feathers exactly similar to those of the back, which, it should be observed, divide as it were from a middle line, and fall gracefully over on either side. The colour of the bill and legs is of a dusky black; and that of the iris dull brown. There appears to be but little difference in colour between the two sexes; but the young, on first quitting the shell, have a much more elegant livery. A brood of these has lately (1831) been hatched at the Society's garden, in which the ground colour is greyish-white, marked with two longitudinal broad black stripes along the back, and two similar ones on either side, each subdivided by a narrow middle line of white. These stripes are continued along the neck without subdivision, and are broken on the head into irregular spots. Two other broken stripes pass down the fore part of the neck and breast, and terminate in a broad band passing on either side across the thighs. As in the fully-grown bird, the bill and legs are of a dusky hue.'

Food, Habits, &c.—The food of the Emeu consists of vegetables and seeds, but chiefly of fruits, roots, and herbage. In a state of nature it is very fleet and affords excellent sport in coursing with dogs, which are however rather shy of their game, in consequence of the powerful kick that the bird can inflict, so powerful that the settlers say it can break the bone of a man's leg by striking out with its feet. Well-trained dogs therefore, to avoid this infliction, run up a-breast and make a sudden spring at the neck of the bird. Though the Emeu has bred so frequently in captivity, the mode of making the nest in the wild state does not appear to be well known, though it is generally supposed to be a mere hollow excavated in the earth. The dark green eggs are six or seven in number. The birds appear to be tolerably constant in pairing, and the male bird sits and hatches the young, whilst the female watches and guards the nest. The Emeu can produce a hollow drumming sort of note, well known to those who have attended to its manners in captivity. These birds will, like the *Rhea*, take water. Captain Sturt, when descending the Murrumbidgee, in Australia, saw two of them in the act of swimming. They appear to be gregarious, and not very shy in some localities, for Major Mitchell in his excursion towards Port Phillip found them very numerous on the open downs, and their curiosity brought them to stare at the horses of the party, apparently unconscious of the presence of the riders. In one flock he counted thirty-nine, and they came so near that the gallant traveller, having no rifle with him, was tempted to discharge a pistol at them, but without effect.

Geographical Distribution.—Widely diffused over the southern part of New Holland and the neighbouring islands; but gradually disappearing before the encroachment of civilized man. They have also been observed on the west coast (Swan River). Captain Flinders found them in abundance at Port Phillip and King George's Sound, and D'Entrecasteaux at the latter place. Flinders and Péron saw them in numbers at Kangaroo Island.

Utility to Man.—The flesh of the Emeu, particularly the hind quarters, is generally described to be good and sweet eating.

But one species of *Dromaius* has hitherto been recorded: but the indefatigable zoologist Mr. Gould has arrived at the safe conclusion that a second species has existed, if it does not still exist, though he has his fears that it may be extirpated. Two specimens at least, he kindly informs us, exist in the museums; one at the *Jardin des Plantes*, and the other in the Linnean collection. Mr. Gould, to whom we may look for a speedy publication of the characters of this new and most interesting addition to the *Struthionidæ*, has in his MS. designated this smaller species as *Dromaius parvulus*, and has placed that name on the bird in the Paris Museum. By his liberality we are permitted to lay this valuable information before our zoological readers. Mr. Gould believes that portion of Australia called New South Wales to be the habitat of *D. parvulus*.

The *Dromiceius Novæ Zealandiæ* of M. Lesson is no other than the highly curious bird which we must next describe, and which he himself on the next page gives to his readers under its proper name of

APTERYX. (Shaw.)

'If,' writes Professor Owen, 'The *Apteryx* of New Zealand were to become extinct, and all that remained of it, after the lapse of one or two centuries, for the scrutiny of the naturalist, were a foot in one museum and a head in another, with a few conflicting figures of its external form—one representing it in the attitude of a terrestrial bird: another, like that in Dr. Shaw's 'Miscellany,' portraying it erect like a Penguin—the real nature and affinities of this most remarkable species would be involved in as much obscurity, and would doubtless become the subject of as many conflicting opinions among the ornithologists of that period, as are those of the Dodo at the present day.'

In 1812 Captain Barclay, of the ship Providence, brought a specimen from New Zealand, and presented it to Dr. Shaw, who figured it as above noticed. When Dr. Shaw died, this specimen came into the possession of the present Earl of Derby, the president of the Zoological Society of London, then Lord Stanley, and then distinguished, as he is now, for the value and beauty of his collection both of living animals and preserved birds, and his munificent patronage of zoology. M. Temminck placed it with the Dodo among the *Inertes*, but still hardly anything was generally known of the bird till Mr. Yarrell, in 1833, described and figured the Earl of Derby's original specimen, collecting in his paper, in the first volume of the 'Transactions of the Zoological Society, all that had been previously made known on the subject. M. Lesson, in the *Zoologie* of the *Voyage*

* N.B. This is not quite correct. In the African Ostrich the feathers have no accessory plume, neither have those of the Apteryx. A tuft of down represents the accessory plume in the Rhea. In the Emeu this plume equals the original feather, so that the quill supports two shafts. In the Cassowary, besides the double feather, there is also a second accessory plume, so that the quill supports three distinct shafts and vanes. (Owen.)

de la Coquille (1829) had noticed the existence of 'a bird without wings,' fragments of which were brought by the natives, which appeared to him to be those of the Emeu, and he says that M. Kendal had confirmed this idea by affirming the existence of Cassowaries analogous to those of Australia in the woods of New Zealand. He adds that the natives call the bird *Kivikivi*, and hunt it with dogs, and that he doubts not that the bird is the *Apteryx Australis* of Shaw.

In the 'Voyage de l'Astrolabe,' M. d'Urville states that it was in the Bay of Tolaga, or Houa-houa, on the east coast of the most northern of the two islands of New Zealand, that he obtained the first positive intelligence as to the nature of the *Keivi*, as he writes it, from observing a mat or dress (natte) adorned with the feathers of the bird, which is one of the first objects of luxury to the natives. According to them, he adds, the *Keivi* is a bird of the size of a small turkey, but, like the ostrich and cassowary, deprived of the faculty of flight, common in the neighbourhood of Mont Ikou-Rangui, and is hunted at night with torches and dogs. M. d'Urville concludes by remarking that it is probable that these birds belong to a genus closely approximating to the cassowaries, and that he believes that it has already received the name of *Apteryx* from some authors; and he mentions a second time the dresses of the chiefs on solemn occasions as being ornamented with the feathers, and refers to the following note in Cruise's *Journal of a Residence in New Zealand* (1822):—'The Emu is found in New Zealand, though we were never fortunate enough to meet with one. The natives go out after dusk with lights, which attract their attention, and they kill them with dogs. Their feathers are black, smaller and more delicate than those of the Emu of New Holland; and a mat ornamented with them is the most costly dress that a chief can wear.'

MM. Quoy and Gaimard, in the *Zoologie* of the same voyage, allude to the bird, which they found it impossible to obtain, but brought back the mantle of a chief covered with its plumes.

Bill of Apteryx. (Owen.)

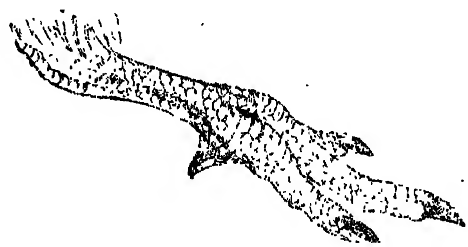
Mr. Gould, who has given beautiful and accurate figures of the bird in his grand work *The Birds of Australia*, states that since Mr Yarrell wrote, he had become acquainted with five additional specimens, and had obtained further information respecting the history of the species. Two of these, from which his figures are taken, were presented to the Zoological Society by the New Zealand Company; and that Society possesses a third but imperfect specimen, presented by Alexander MacLeay, Esq., of Sydney. Two others have been recently added to the collection of the Earl of Derby, one of which his lordship liberally presented to Mr. Gould.

Description.—Face and throat greenish brown; all the remainder of the plumage consisting of long lanceolate hair-like feathers of a chestnut-brown, margined on each side with blackish brown; on the lower part of the breast and belly the feathers are lighter than those of the upper surface, and become of a grey tint; bill yellowish horn-colour, its base beset with numerous long hairs; feet yellowish brown. (Gould.)

This is the *Apteryx Australis* of Shaw; *Apteryx* of Temminck; *Apterous Penguin* of Latham; and *Kivi-Kivi* or *Kiwi-Kiwi* of the aborigines of New Zealand.

The length from the point of the bill to the end of the tailless body is about thirty-two inches; but the bill is much longer in some individuals than in others, and it is not satisfactorily made out whether this difference of length is to be attributed to difference of age or sex; but it has been supposed that the female has the longest bill.

The toes are four in number; the three anterior ones are unconnected. The hind toe is placed on the inner flattened surface of the tarsus; is directed backwards, and almost perpendicularly downwards, it measures only 1¼ inch, and of this the claw or spur measures ¾ of an inch. In the size and position of this toe the *Apteryx* corresponds with the *Dodo*.



Foot of Apteryx.

Food, Habits, &c.—Worms, insects, especially the larvæ of *Lepidoptera*, and probably snails, appear to be the food of this species. Mr. Gould states that the favourite localities of the bird are those covered with extensive and dense beds of fern, among which it conceals itself, and when hard pressed by dogs, the usual mode of chasing it, it takes refuge in crevices of the rocks, hollow trees, and in the deep holes which it excavates in the ground in the form of a chamber. In these latter situations, Mr Gould tells us, it is said to construct its nest of dried fern and grasses, and there deposits its eggs, the number and colour of which have not been clearly ascertained.

Apteryx Australis. (Gould.)

Mr. Short, in a letter to Mr. Yarrell, states that when undisturbed, the head is carried far back in the shoulders, with the bill pointing to the ground; but when pursued, it runs with great swiftness, carrying the head elevated like the ostrich. Its habits are said to be almost exclusively

nocturnal, and the natives usually hunt it by torchlight, seeking for it with the utmost avidity, the skins being so highly prized for the dresses of the chiefs, and indeed the natives can be rarely induced to part with them. The feathers are also used for artificial flies in angling, after the European manner. When attacked, it vigorously defends itself, striking rapidly and dangerously with its powerful feet and sharp spur, with which it is also said to beat the ground, in order to disturb the worms, on which it feeds, seizing them with its bill the instant they make their appearance.

Geographical Distribution.—The *Apteryx* is said to inhabit all the islands of New Zealand, particularly the southern end of the middle island. (*Birds of Australia.*)

FOSSIL STRUTHIONIDÆ.

In November, 1839, Professor Owen exhibited, at a meeting of the Zoological Society of London, the fragment of the shaft of a femur, six inches in length, and five inches and a half in its smallest circumference, with both extremities broken off. This bone of an unknown struthious bird of large size, presumed to be extinct, was put into the Professor's hands for examination, by Mr. Rule, with the statement that it was found in New Zealand, where the natives have a tradition that it belonged to a bird of the Eagle kind, which has become extinct, and to which they give the name 'Movie.' Similar bones, it is said, are found buried in the banks of the rivers.

After a minute description of the bone, Professor Owen proceeds thus:—'There is no bone of similar size which presents a cancellous structure so closely resembling that of the present bone, as does the femur of the ostrich; but this structure is interrupted in the ostrich at the middle of the shaft, where the parietes of the medullary, or rather air-cavity, are smooth and unbroken. From this difference, I conclude the Struthious bird indicated by the present fragment to have been a heavier and more sluggish species than the ostrich: its femur, and probably its whole leg, was shorter and thicker. It is only in the ostrich's femur that I have observed superficial reticulate impressions similar to those in the fragment in question. The Ostrich's femur is subcompressed, while the present is cylindrical, approaching in this respect nearer to the femur of the Emeu: but its diameter is one-third greater than that of the largest Emeu's femur with which I have compared it. The bones of the extremities of the great *Testudo Elephantopus* are solid throughout. Those of the crocodile have no cancellous structure like the present bone. The cancellous structure of the mammiferous long bones is of a much finer and more fibrous character than in the fossil. Although I speak of the bone under this term, it must be observed that it does not present the characters of a true fossil; it is by no means mineralized: it has probably been on or in the ground for some time, but still retains most of its animal matter. It weighs seven ounces twelve drachms avoirdupois.

'The discovery of a relic of a large struthious bird in New Zealand is one of peculiar interest on account of the remarkable character of the existing Fauna of that island, which still includes one of the most extraordinary and anomalous genera of the struthious order; and because of the close analogy which the event indicated by the present relic offers to the extinction of the Dodo of the island of the Mauritius. So far as judgment can be formed of a single fragment, it seems probable that the extinct bird of New Zealand, if it prove to be extinct, presented proportions more nearly resembling those of the *Dodo* than of any of the existing *Struthionidæ*. Any opinion however as to its specific form can only be conjectural; the femur of the Stilt-bird (*Himantopus*) would never have revealed the anomalous development of the other bones of the leg; but so far as my skill in interpreting an osseous fragment may be credited, I am willing to risk the reputation for it on the statement that there has existed, if there does not now exist, in New Zealand, a struthious bird nearly if not quite equal in size to the ostrich.' (*Zool. Proc.*, 1839.)

The account of the bones found buried in the Isle of France and the island of Rodriguez will be found in the article DODO, vol. ix., p. 52.

And here we close an abridged account of perhaps the most interesting family in the whole class of birds, hoping however that no material omission will be found, whilst, through the kindness of friends, we have been enabled to present our readers with some information not previously published. When we look at the bisulcous ostrich, with its large ventricle between the crop and the stomach, and its vast receptacle where the urine accumulates, as in a bladder, we may well excuse the antients for their doubts as to the place of the animal. 'The name of Camel-Bird, by which it was known not only to the Greeks and Romans, but also to the nations of the East; the broad assertion of Aristotle that the ostrich was partly bird and partly quadruped; and that of Pliny, that it might almost be said to belong to the class of beasts, are,' as Mr. Bennett well says, 'but so many proofs of the popular recognition of a well authenticated zoological truth.' In the *Cassowary*, the *Emeus*, and the *Apteryx*, the covering of the body becomes something between feathers and hair: in the *Cassowary* and *Emeu* the wing is dwindling rapidly; and in *Apteryx* this great characteristic of the birds is reduced to a mere rudiment; while in all, the lower extremities, with which they kick like quadrupeds, are most highly developed.

STRUTT, JOSEPH, an artist and antiquary of considerable merit, was born at Springfield, in Essex, Oct. 27, 1749. His father was the owner of a mill at Springfield. At the age of fourteen the son was apprenticed to the unfortunate William Wynne Ryland, the engraver, and afterwards became a student of the Royal Academy, where he tried his talent at painting in oil. In 1771 he became a student in the reading-room of the British Museum, the manuscript stores of which gave a new bias to his pursuits, and where he conceived, and obtained the chief embellishments for, most of the literary labours which he afterwards executed.

In 1773 he published his first work, 'The Regal and Ecclesiastical Antiquities of England, containing the representations of the English monarchs from Edward the Confessor to Henry VIII.,' a thin volume in quarto; a new edition of which he published, with a Supplement, in 1793.

In 1774 he published the first volume 4to. of what he called '*Horda-Angel-Cynnan*, or a complete View of the Manners, Customs, Arms, Habits, &c. of the Inhabitants of England, from the arrival of the Saxons; the second volume of which appeared in 1775, and the third in 1776.

In 1777 and 1778 he published his 'Chronicle of England,' in 2 vols. 4to. He had intended to bring this work down to his own time in six volumes, but not meeting with the encouragement he looked for, he stopped at the Norman Conquest.

His next work was 'A Biographical Dictionary, containing an Account of all the Engravers from the earliest period to the present time, illustrated by engravings,' 2 vols. 4to., London, 1785 and 1786; a work very creditable to his judgment and industry.

In 1790 an asthmatic complaint rendered a country residence necessary, when he retired to Bacon's farm in Hertfordshire, where he employed a part of his time in engraving a series of plates in illustration of 'Pilgrim's Progress.' Here he remained for four or five years.

In 1795 he returned to London, and began collecting materials for his 'Complete View of the Dress and Habits of the People of England from the establishment of the Saxons in Britain,' the first volume of which he published in 1796, and the second in 1799.

In 1801 he published the last work he lived to complete, on 'The Sports and Pastimes of the People of England,' 4to.: reprinted in 1810, 4to., and again in 8vo. edited by William Hone, in 1830.

He died, in narrow circumstances, in Charles Street, Hatton Garden, October 16th, 1802. He left some manuscripts in the possession of his son, from which 'Queen Hoo Hall,' a romance, and 'Antient Times,' a drama, in 4 vols. 12mo.; and 'The Test of Guilt, or Traits of Antient Superstition, a dramatic tale, with the Bumpkin's Disaster, &c.' 4to., have been since published.

Nichols, in his 'Literary Anecdotes,' whose account we have principally followed, enumerates (vol. v., p. 685, 686) a considerable number of single plates which Mr. Strutt engraved and published, as well as a few paintings in oil and drawings.

STRUVE, GEORG ADAM, was born at Magdeburg, on the 26th of September, 1619. His father, the proprietor of Wandesleben, was judge in the supreme court of the duchy of Magdeburg. The family of Struve came originally from Brunswick, in which the grandfather of the subject of this sketch possessed an equestrian fief. Some of the ancestors of the mother of G. A. Struve had occupied high judicial offices, and others had pursued, with success, the career of University honours.

Struve's father was too much occupied by his judicial

duties to superintend the minute details of his son's education; but his mother laboured anxiously to instil devotional feelings into his infant mind. He received instruction in the first elements of Latin, and other branches of knowledge, at the lyceum of Magdeburg, until he attained his eleventh year. In 1630 he was sent to the gymnasium of Schleusingen, where he remained till 1636. His principal tutor was Reyher, a man of great reputation as a teacher, who, besides grounding him thoroughly in Greek and Latin, imparted to him some notions in philosophy and belles-lettres.

His family had suffered much during these six years from the destruction of Magdeburg by Tilly's army, and the devastation of the district in which their property lay. They led an unsettled life for several years, sometimes in one town, sometimes in another, till the storm of war having drifted into other provinces, they ventured again to take up their abode at Magdeburg. Not long after their return, Georg Adam arrived at the house of his parents a few days sooner than he was expected. Six years had so completely changed his appearance, that he was received as a stranger both by his parents and sisters, who did not recognise him until he declared himself.

In June, 1636, Struve entered the University of Jena. The taste which he had acquired for literature and science, under his schoolmaster, prompted him, although the law was his professional study, to devote a good deal of time to the philosophical classes. He attended the lectures of Philip Herst upon ethics; of Daniel Stahl upon logic and metaphysics, of Johann Zeisold upon physics, of Johann Michael Dehlerr upon oratory and history. These were branches of knowledge which the jurists of his day were only in a few rare instances beginning to cultivate, but he found, in after-life, advantage from this preliminary intellectual discipline. Even at this early age, if we may credit the narrative of his son, he had become aware of the important lights which a study of history was calculated to throw upon the doctrines of law, and the advantage a lawyer might derive from cultivating a logical precision in the statement of his arguments and an elegant diction. So strong was his sense of the latter requisite, that, in addition to the public lectures on rhetoric, he attended private classes for practical exercise in oratory. Seeing also how much depended in law upon precision of language, he extended his inquiries into the field of philology.

All these pursuits however were carried on in subordination to his legal studies. He attended the lectures of Peter Dieterich, Erasmus Ungebauer, and Ortholph Fomman. The last-mentioned was a relation of Struve's mother, and the young man had been confided to his superintendence, a trust which he conscientiously discharged by a watchful direction of his private studies. Struve had no relish for the wild merriment which then, even more than in modern times, was characteristic of the German student. He seems to have been of a quiet and even timid disposition, for a fright that he got from some soldiers, when a marauding party plundered Jena, soon after his arrival at the University, impaired his health sensibly for several years. His irreproachable conduct prepossessed the professors in his favour; and the distinguished appearance he made in a disputation which he maintained, in the philosophical faculty, on his thesis 'De Victoria et Clade,' in 1638, raised great expectations of his future eminence. He quitted Jena on the 11th of September, 1639, and his public certificate from the heads of the University was more than usually flattering.

He remained upwards of a year in his father's house for the purpose of re-establishing his health, which had not yet recovered from the effects of the shock above alluded to. In the year 1641 he entered himself at the University of Helmstädt, where he remained till April, 1645. Hermann Conring was then in the vigour of life: Struve attended during the summer of 1641 his lectures on the history of antient Germany, to which the 'Germania' of Tacitus served as a text-book. In the winter of the same year he heard Rudolph Diephold's lectures upon 'genealogia historica,' as a supplement or continuation of Conring's; whose lectures upon politics he attended at the same time. In 1642 he was a member of a class to which Conring expounded the 'Politics' of Aristotle. Heinrich Hahne, at that time the most esteemed civilian in Germany, had ceased to lecture, but Struve was fortunate enough to be selected as his amanuensis on some occasions, and heard the 'Pandects' explained by his colleague Wesenbeck. His relation with Conrad Horn was more intimate, for his father had placed him under the immediate control of that professor, who exercised him, along with his other pupils, unremittingly in private disputations. In January, 1642, Struve maintained a public disputation in the juridical faculty, on a thesis 'De Damnis, illis præcipue quæ ex dolo, culpâ, aut casu proveniunt, harumque correctionibus et præstationibus.' And in July, 1643, he maintained one in the philosophical faculty, on a thesis 'De Ducibus et Comitibus Imperii Germanici.' In February, 1645, he again supported a juridical thesis 'De Vindicta Privata;' and having been admitted to the preliminary examinations, received his licence as candidate for the degree of Doctor of Laws.

Two months thereafter, before he had completed his 26th year, he was appointed by Augustus, duke and archbishop of Magdeburg, assessor to the magistrates of Halle, an office which he retained not quite a year and a half. In the month of February, 1646, he received as a matter of course the title of Doctor; and in the December following he was called to fill the chair of law in the university of Jena, left vacant by the death of Fibigius. He was admitted an assessor to the magistracy in January, 1647; and in June, 1648, an assessor to the high court of the circle of Saxony. He continued in the discharge of his judicial and academical duties till 1667. His opinions were in great request both in controversies relating to public and those relating to private rights. The town of Brunswick, being at that time involved in a dispute regarding its privileges with the duke, requested Struve to undertake the management of their legal business; and he, having obtained the consent of the patrons of the university, was appointed, on the 26th of March, 1661, counsel in ordinary to the good town of Brunswick for three years, with an annual salary of 300 dollars, becoming bound to advise its magistrates in writing whenever called upon, and, if necessary, to visit the town four times in the year. The duke and town having settled their dispute by a compromise, this connection was dissolved in December, 1663. At first Struve lectured upon the 'Institutes,' a duty devolving upon the youngest professor. As his seniors died off, he was called in succession to lecture upon the 'Pandects,' the 'Code,' and ultimately upon feudal law. Entertaining from his own experience a high opinion of the benefit to be derived from disputations, he encouraged his pupils to engage in them frequently among themselves under his guidance; and in course of time the idea suggested itself to him of making the young men maintain in succession disputations on all the leading doctrines of the branch of law he might be lecturing upon at the time. From a series of theses impugned and defended in this manner arose his 'Syntagma Juris Feudalis,' first published in 1653, and his 'Syntagma Juris Civilis,' first published in 1658.

He received unexpectedly, in the year 1667, the appointment of privy counsellor to the dukes of Weimar, and transferred himself with his family to the seat of government in the month of December. His discharge of the duties of this office gave so much satisfaction, that when the line of Saxe-Altenburg became extinct in 1672, and doubts were entertained whether the line of Gotha or Weimar had the nearest claim to the succession, he was selected as the ablest person to advocate the cause of his masters. In the conduct of this delicate business he had the merit or good fortune to give entire satisfaction, both to the party for whose interests he acted, and that to which he was opposed. When the territories of the house of Weimar were divided between the brothers, he remained in the service of the duke of Weimar. Notwithstanding the load of public business which devolved upon him during this period of his life, he contrived to find some time for the literature of his profession. He published in 1669 answers to objections which had been urged against some of the doctrines maintained in his 'Syntagma Juris Civilis,' a work which had however been completed before he left Jena. He compiled his remarks on the 'Immo' of Gothofredus, which his son Burkhard Gotthelf published at Frankfort after his death. In 1668 he published 'Jus Sacrum Justinianeum.'

The Ordinarius of the Judicial College of Jena died in 1674; and notwithstanding the active competition of the most distinguished German jurists for so honourable and lucrative an employment, Struve was selected by the patrons of the university as the best qualified for the office, along with which the professorship of canon law was then uni-

formly held. On the 28th of July, he made with his family a sort of triumphal entry into Jena; for the citizens and the members of the university met him in procession at some distance from the town. The important offices to which he had been appointed he continued to fill till his death, although the active discharge of their duties was interrupted for a time by the affairs of the regency of Jena.

On the death of Duke Bernard, to whose share the duchy of Jena had fallen at the partition of the Weimar territories, his son Johann Wilhelm, a minor, succeeded. His uncle Johann Ernest of Weimar was guardian, but it was deemed expedient that a permanent council of regency should sit at Jena. Struve was appointed president of this body about the end of August, 1680. In virtue of this appointment, the whole burden and responsibility of the general executive government of the territory, the discharge of the consistorial business, and the management of the finances, fell upon his shoulders. He was obliged to relinquish to another the discharge of his professorial duties, reserving however his appellate jurisdiction as ordinarius. So many cares naturally distracted his attention from his own private concerns, which were considerably dilapidated in consequence of his elevation. His pre-eminent position too exposed him to much malevolence; but he laboured indefatigably, and gave satisfaction both to the duke of Weimar, and to the duke of Eisenach, who at his death succeeded him in the regency. The young duke of Jena died towards the close of 1690, not long after a partition was agreed to by the lines of Weimar and Eisenach, and the council of regency being dissolved in consequence, Struve was restored to his academical functions.

His life at Jena, both before and after this interruption, though a busy was a uniform one. As privy counsellor he attended every consultation to which he was summoned by the dukes his masters. As Ordinarius he presided both in the ordinary and appellate tribunals of Jena. He prepared opinions in reply to the cases addressed by numerous applicants either to the Judicial College of Jena or to himself individually. In addition to these occupations, he faithfully expounded to his pupils the doctrines of the canonical law as then received in the courts of the Protestant states of Germany. After the dissolution of the regency, he did not again enter the academical chair, but continued nevertheless, with unabated diligence, to urge on the literary undertakings to which his professional duties had prompted him, and which, even whilst acting as vice-regent, he had not neglected. He prepared a new edition, with notes explanatory of the points in which the Lutheran deviated from the Roman Catholic system of canon law, of Valerius Andrea's treatise on that branch of jurisprudence, which he used as a text-book; but it was not published till 1680, when other cares prevented him from continuing his lectures. The chief ambition of his later life was to bring the canonical law of Protestant Germany into a better and more systematic form. With that view he projected various works; but on account of their extent, and the interruptions he experienced, only fragments of them were completed. A projected 'Jurisprudentia Canonica,' after the model of his own 'Jurisprudentia Romano-Germanica,' remained a mere project. Of a complete 'Commentary on the Five Books of the Decretals,' only that which relates to the fifth book, 'De Delictis,' was published, at Jena in 1691: it appears that his son Georg Gottlieb acted as editor. It was his intention to treat the doctrine of marriage in a much fuller manner in his annotations on the fourth book: valuable materials were collected for the purpose; and he had resolved making his son Burkhard Gotthelf digest them under his own superintendence and direction, but the young man preferred accepting the invitation of his brother at Darmstadt, as has been noticed in the preceding article. The materials for a projected treatise 'De Causis et Beneficiis Ecclesiasticis' were in like manner left unarranged at his death. The materials and plans of the great structure he contemplated alone survived him. He found time, amid all his labours, to compile a system of the common law of the Empire in the German language, a work which was undertaken at the request of Duke Ernest of Gotha, and published in 1689. It was the first German treatise of the kind, and gave a severe shock to the prejudices of most of his contemporaries. The autumn before his death he undertook to prepare an edition of the 'Criminalia' of Carpzovius for a Leipzig bookseller, but death prevented him.

His son remarks that his energy and love of life seemed materially to abate after the shock he received by the death of the young duke. He continued however without intermission the arduous duties of his office, and was seized in court with the illness which carried him off in less than twenty-four hours. It was a maxim which he was fond of repeating, that 'the Ordinarius of Jena ought to die standing.'

Georg Adam Struve was twice married. His first wife was the daughter of Christopher Philip Richter, whom he succeeded as Ordinarius. They were married on the 6th of November, 1648, and lived together fourteen years, during which time she brought him eight children, all of whom died before him except two, Friedrich August, who inherited the property of his maternal grandfather, and died two years after his father, and Johann Wilhelm, a practising lawyer of considerable eminence, long resident in Darmstadt, of whom mention has been made in the preceding article. Conscious that his professional duties incapacitated him from paying the necessary attention to the education of his children, Struve, soon after the death of his first wife, began to look about for a second. His choice fell upon Susanna Berlich, daughter of a distinguished lawyer resident in Dresden. They were married on the last day of October, 1663; and she survived him six years. She brought him seventeen children, of whom four sons and one daughter survived him. Three of the sons, Georg Gottlieb, Burkhard Gotthelf, and Friedrich Gottlieb, embraced the legal profession, but only the second attained to any eminence. Ernst Gotthold was a practising physician in Brunswick. Two of Struve's daughters married lawyers: so that he descended from one line of jurists, and was the progenitor of another.

His published works are—'Syntagma Juris Feudalis,' Jenæ, 1653; ibid., 1659; Frankfort, 1703-4. To the later editions are appended 'Observationes feudales juxta syntagmatis juris feudalis ordinem digestæ;' 'Decas Consiliorum et Responsorum Feudalium.' and 'Centuria Decisionum, quænam res feudales, quænam allodialis.' 'Syntagmata Jurisprudentiæ Civilis,' Jenæ, 1665 (frequently reprinted); 'Jurisprudentia Romano-Germanica Forensis,' Jenæ, 1670; 'Jus Sacrum Justinianeum, sive Progymnasmata ad Titulos priores Libri i. Codicis,' Jenæ, 1668, 4to.; 'Evolutiones Controversiarum in Syntagmata Juris Civilis comprehensarum,' Jenæ, 1669; 'Triga Dissertationum: de Vindicta privata et retorsione juris iniqui; de aedificiis privatis; et de annona,' Jenæ, 1670; 'Dissertationes Criminales XVI. in academia Salana publicæ disquisitioni præpositæ,' Jenæ, 1671; 'Decisiones Sabbathinæ, Canonicæ et Practicæ; Selectiones de Conventionibus et Contractis,' Jenæ, 1677, 4to.; 'Notæ et Observationes Theoreticæ, Canonicæ et Practicæ, ad Antonii Matthaei Tractatum de Successionibus,' Jenæ, 1678, 4to: 'Valerii Andreæ Desselii Erotemata Juris Canonici, cum animadversionibus,' Jenæ, 1680 and 1691, 8vo.; 'Dissertatio Juridica de Invocatione Nominis Divini,' Jenæ, 1682, 4to.; 'Jurisprudentz, oder Verfassung der Landüblichen Rechte,' Mersburg, 1689, 8vo.; 'Commentarius ad Librum V. Decretalium de Delictis, Cura Georgii Gottlebii Struvii,' Jenæ, 1691, 4to.

The writings of Georg Adam Struve indicate a mind which, as far as it could see, saw distinctly and correctly. He belonged, notwithstanding his studies in philosophy and history, rather to the race of jurists which preceded him, than to the more accomplished race which succeeded him. His historical erudition is very deficient in critical discrimination; and he labours painfully to torture the doctrines of law into the formulæ of scholastic logic. It was as a practical lawyer that he distinguished himself; a character for which perhaps even the limited range of his mental vision peculiarly qualified him; but towards the formation of which his robust yet tranquil constitution both of mind and body, his clearness of apprehension, self-possession, and moral courage, but above all his high and pure sense of moral rectitude, were invaluable ingredients. His influence in the development of German jurisprudence was exercised as presiding judge in an important appellate tribunal; as a consulting lawyer whose opinions were highly valued throughout all Germany; and as a judicious former of the minds of youth. He worked more through the jurists he trained, than by his own works. Georg Adam Struve was one of those robust, quiet, powerful natures which are of more importance in society than nine-tenths of the more glaring personages who engross the admiration of the multitude.

(*Pii Manes Struviani, sive de Vita et Scriptis Georgii Adami Struvii, Illustris quondam Jurisconsulti quibus*

justa persolvit mœstissimus filius Burcard Gotthelf Struve, Jenæ, apud Johannem Bielkium, 1705.)

STRUVE, BURKHARD GOTTHELF, third son by the second marriage of Georg Adam Struve, was born at Weimar on the 26th of May, in the year 1671, and was carried to Jena when his father transferred his residence to that University, on receiving the appointment of Ordinarius of the Judicial College there, in 1674. Great pains were taken with his education by his parents: and in after-life Struve often acknowledged his obligations to Johann Friedrich Durre, who had the charge of his elementary education. An incident mentioned in the Memoir of his father, which he published in 1705, almost leaves the impression that the old gentleman treated him in boyhood like a favourite plaything. The last time Georg Adam Struve presided at the creation of a number of doctors of law, in the year 1680, he commanded Burkhard, then a boy of nine years only, to make his remarks, and put questions with the rest of the assembly.

Not long after this event the boy was sent to the gymnasium at Zeitz, and confided to the care of Christopher Cellarius, rector of the institution. Young Burkhard made himself so useful to his preceptor, both in his private study and in the public library, that he gained his confidence sufficiently to be employed as an assistant upon the corrected and enlarged edition of Faber's 'Lexicon,' which he had undertaken to publish.

Burkhard Gotthelf Struve, having attained his seventeenth year, returned to Jena for the purpose of commencing his university studies, in 1788. His father, who was then engrossed with the labours which fell to his share as president of the regency of the duchy of Jena, had relinquished for a time the active discharge of the professorial office At the urgent request of his son however he consented to give private instruction, on Wednesdays and Saturdays, to him and eleven of his young associates, in the system of Romano-Germanic law recognised by the tribunals of Germany, and the plan of tuition pursued was to examine the pupils upon the elementary treatise on this branch of law compiled by their instructor, and to exercise them in arguing upon controverted doctrines. Burkhard attended at the same time the prelections of Johann Hartung and Peter Müller in Roman law. He seems however to have been a more assiduous frequenter of the literary classes of Jacob Müller, Andreas Schmidt, and especially of Georg Schubart, then rector of the University, under whose presidency he held, in 1689, a public disputation upon some theses appended to his dissertation 'De Ludis Equestribus.' Not long after he disputed in the juridical faculty on the legal doctrines 'De Auro Fluviatili;' and on both occasions he is said to have impressed his auditory with admiration of his precocious talents. While thus engaged, he did not neglect pursuits more consonant to the tastes of his age, country, and academical associates. He learned dancing, and was for a time a frequent attendant in the fencing-school. Tiring however of these pursuits, he devoted himself with ardour, in his leisure hours, to the study of the French language. In the Memoir of his father, already alluded to, he mentions that about this time he was employed by his father in a collation of his Latin treatise 'Jurisprudentia Romano-Germanica Forensis,' with his work on the same subject in German, to show that the one was not a mere translation of the other, but a different work. The statement which Burkhard drew up on this occasion was meant to be inserted in the pleadings of the publisher of the German work, against whom the publisher of the other had brought an action; but it was published, at a later period, by the bookseller, as a preface to a new edition, without the compiler's knowledge or consent. An exercise of this kind, and the repetitions under his father, were well calculated to impress the leading doctrines of the law upon his memory.

Towards the close of the same year in which he maintained his first public disputations, Burkhard Gotthelf Struve repaired to the university of Helmstädt, for the purpose of studying history under Heinrich Meibom, and civil law under Georg Engelbrecht. After a year's residence at Helmstädt he went to Frankfort on the Oder, in order to profit by the instructions of Samuel Stryk and Peter Schulz. During his abode at Frankfort he engaged in a controversy which led him to appear for the first time in print. An obscure jurist of the name of Schnegas had published, in 1689, a treatise 'De Concursu Creditorum,' in which he attacked some doctrines laid down by the elder Struve, in his 'Institutes of Forensic Law,' regarding the classification of creditors and the right of property in dowry. Burkhard asserted the correctness of his father's views in a pamphlet, which he called 'Struvius non Errans,' and which, to judge by the warmth with which he speaks of the controversy at a much riper age, must have been rather bitter. Schnegas replied in the same strain, but his young antagonist was induced by the advice of older and cooler friends to allow the matter to rest.

In 1691 Stryk having accepted of a chair in the university of Wittenberg, Struve returned to Jena, and was soon after sent to Halle by his father, with a view to his attending the sittings of the supreme court there, in order that he might make himself master of the forms of process. The dry details of legal practice were repulsive to a mind early accustomed to the self-indulgent habits of the abstract student, and to the applause attendant upon skill in mere literary controversy. Instead of frequenting the court, he directed himself almost exclusively to the theory and antiquities of public and feudal law. In such a frame of mind he lent a willing ear to the inducements held out by an elder brother to make a tour to Belgium, and afterwards join him at Darmstadt, where he was established as a practising lawyer. He in consequence visited in succession Gotha, the Hague, Amsterdam, Rotterdam, and Leyden, and was everywhere, on account of his father's reputation, kindly received. He afterwards confessed that his thoughts during this journey were rather distracted by the gaiety and splendour of the towns he visited, than earnestly bent upon extending his knowledge; nor was this very unpardonable in one who had only completed his twentieth year. He did however derive some benefit from the conversation of distinguished scholars in Utrecht and Leyden.

At the request of his brother he repaired to Frankfort to take charge of some business for the transaction of which he required a confidential agent in that town. It was the time of the fair, and the novelty and bustle of the scene left a lasting impression upon Struve's mind. The affairs which required his presence there being arranged, he returned to the Hague, and, the first distraction of travelling having worn off, settled to study. The favourite pursuits of the Dutch literati extended his field of inquiry. On the one hand, the Hague being then a centre of an active diplomacy, his investigations regarding public law were enabled to assume a more practical and real character. The literary pursuits too of his new associates had more of the tone of society than those which prevailed in the German universities. On the other hand, the museums of Holland, and especially the collections of coins and other antiquities, attracted him to inquiries for which his investigations into the antiquities of feudal law had in some measure prepared him. During his residence at the Hague he was indefatigable in his visits to all the museums and libraries, and in his study of the periodical literature, which opened in a manner a new world to him. He made for himself a considerable collection of coins and antiquities. While thus engaged, and projecting a tour through Spain and Great Britain, he was seized with a violent illness, which interrupted his pursuits.

On his recovery he rejoined his brother, and was employed by him at various times to conduct actions for him in the courts of Darmstadt, Stuttgard, and Cassel. He was induced about this time by the fair promises of a Livonian nobleman to undertake a journey in his company to Sweden for the purpose of obtaining a more intimate acquaintance with the antiquities of Scandinavia. Struve with this view proceeded to Hamburg, where he was to be joined by his companion. The count not making his appearance however, he returned to his brother, and in the same year (1692) visited Wetzlar, for the purpose of obtaining, by attending the sittings of the imperial court, a more accurate knowledge of the practice of public law. While thus engaged, he was attacked by a more severe illness than the preceding; and some of the symptoms induced a suspicion that it was occasioned by poison. No sooner was he convalescent than he received intelligence of the death of his father, and was obliged to leave Wetzlar in order to look after his share in the inheritance. During the period which elapsed between his quitting the university and his return to Jena, his mind, though stimulated to greater activity and familiarised with objects of greater reality and importance than had previously engaged his attention, had been dissipated and distracted with

their multiplicity. To the end of his life he occasionally expressed regret that he had not, in compliance with the request of his father, remained at Jena, to digest under his direction his collections for a commentary on the law of marriage, an occupation which must have contributed to give him more precision and more command over his thoughts.

On his return to Jena, Struve found one of his brothers eagerly engaged in pursuit of the philosopher's stone. He was of a facile disposition, as is apparent from an anecdote he relates in the Life of his father, of his incurring a rebuke by undertaking to solicit privately for a person whose conduct was under judicial investigation. This easiness of temper at first led him to join in his brother's experiments, but the frenzy seized him in turn, and he was soon as zealous an adept as the other. As might have been anticipated, the search after the secret of making wealth ended in beggaring both. The brother was only saved from a gaol by Struve selling the collection of curiosities he had made in Holland, and even a part of his wardrobe. To the intoxication of his golden dreams succeeded a state of miserable depression which lasted for two years. He secluded himself from society, and absorbed himself in the study of the Scriptures and the theological writings of Tauler and Arndt.

When he recovered his elasticity of mind, he found himself unable to encounter the expense of following out the academical career to which his father had destined him. Some time elapsed before any prospect of employment opened to him. In 1695 he published at Frankfort on the Main some notes on the legal doubts of Gothofredus (known among jurists as the *Immo* of Gothofredus), from a manuscript of his father. In 1696 he published a letter to his old teacher Cellarius, 'De Bibliothecarum harumque Præfectis.' At last, in 1697, he was appointed by the patrons of the university of Jena curator of the library. Upon receiving this appointment, he opened private classes, giving instruction, according as his pupils desired, in physics, the elements of the Greek language, Roman antiquities, or history. The number of young men who attended him excited the envy of the established teachers, and drew down upon him the active enmity of Schubart. It was found necessary to provide himself with a legitimation as teacher; and for this end he, in the year 1702, took the degree of Doctor of Law and Philosophy at Halle, the usual fees being remitted at the solicitation of Stryk and Cellarius.

As soon as he obtained his degree, he took measures for having himself enrolled as Doctor Legens at Jena, and his subsequent career was one of uninterrupted success. On the death of Schubart, he was appointed to the chair of history, and he commenced the discharge of its duties in 1704, by publishing a programma 'De Vitiis Historicorum,' and delivering a public oration 'De Meritis Germanorum in Historiam.' His fame as a public teacher attracted many of the young nobility from all parts of Germany, and among others Prince Ernest Augustus, afterwards duke of Weimar. Having received, in 1712, an invitation to the university of Kiel, he was induced to decline it by the patrons of Jena conferring upon him the office of historiographer to the university, the rank of counsellor, and the appointment of extraordinary professor of law. He was promised the succession to the ordinary professorship of feudal law, which he actually obtained a few years later. In 1717 he was appointed a privy counsellor by the reigning prince of Baireuth; and in 1730 he received the same compliment from the Saxon court. He repeatedly filled the office of Dean in the Philosophical Faculty, and was thrice chosen rector of the university. He died on the 24th of May, 1738, having nearly completed his sixty-seventh year.

Struve was thrice married. He was united to his first wife, Anna Elizabetha Bertram, daughter of an assessor in the court attached to the salt-works of Halle, in 1702, who died in 1706, leaving him two daughters. He married in 1707 his second wife, Rogina Elizabetha Ständler, daughter of the town-clerk of Naumburg on the Sala; the year of her death is uncertain; she left no surviving children. In 1724 he married Sophia Maria, widow of Ernest Friedrich Kittoner, a clergyman in Quedlenburg, who brought him no children.

The published works of Burkhard Gotthelf Struve are very numerous. A complete list of them is given in the 'Acta Eruditorum' of Leipzig, published in 1740. The following are the most important, either on account of their subjects and inherent interest, or of the indications they give of the progress and direction of the author's studies:—'Struvius non Errans,' Franc. ad Viad., 1691, 4to.; 'Bibliotheca Numismatum Antiquorum,' Jenæ, 1693, 12mo.; 'Piа Mœstis Desideria in Obitum Susannæ Berlichiæ, matris piissimæ,' Jenæ, 1699, 8vo.; 'Didaci Saavedræ Abriss eines Christlichen Politischen Prinzen,' Jenæ, 1700, 12mo.; 'Antiquitatum Romanarum Syntagma, sive de Ritibus sacris Systema absolutius, adjecta Bibliotheca, Figuris æneis, et Indicibus necessariis,' Jenæ, 1700; et auctior., 1729, 4to.; 'Acta Literaria ex MStis edita et collecta' (17 fasciculi collated, with the date 1713 on the title-page); 'Bibliotheca Juris Selecta,' Jenæ, 1703 (frequently republished, ultimately with additions by Buder); 'Introductio ad Notitiam Rei Literariæ, et Usum Bibliothecarum,' Jenæ, 1704 (contains the 'Dissertatio de Doctis Impostoribus,' published separately by the author in the preceding year); 'Bibliotheca Philosophica in suas classes distributa,' Jenæ, 1704, 8vo. (frequently republished latterly with additions by Kahl); 'Selecta Bibliotheca Historica,' Jenæ, 1705, 8vo. (republished with additions by Buder); 'Pii Manes Struviani, seu de Vitis et Scriptis Georgii Adami Struvii,' Jenæ, 1705, 8vo.; 'Syntagma Juris Publici Imperii Romano-Germanici,' Jenæ, 1710, 4to. (republished in 1711; and again much enlarged, with the title 'Corpus Juris Publici I. R. G.,' in 1738); 'Syntagma Historiæ Germanicæ, à primâ gentis origine ad annum usque 1716,' Jenæ, 1716, 4to. (subsequently published in an enlarged form, with the title 'Corpus Historiæ Germanicæ, à primâ gentis origine ad annum usque 1730, ex genuinis historiarum documentis, coævorum scriptorum monumentis, diplomatibus, et ex actis publicis, illustratum cum variis observationibus et figuris æneis, adjecto indice locupletissimo, et opusculis ad historiam Germanicam facientibus; præmissa est Chrest. Gottl. Buderi Bibliotheca Scriptorum Rerum Germanicarum, easdem universum illustrantium,' Jenæ, 1730, fol. (a German translation of this work has been published); 'Historia Juris Romano-Justinianei, Græci, Germanici, Canonici, Feudalis, Criminalis, et Publici,' Jenæ, 1718, 4to.; 'Einleitung zur Deutschen Reichs Historie,' Jenæ, 1724, 8vo.; 'Corpus Juris Publici Academicum,' Jenæ, 1726, 8vo (thrice republished); 'Compendium Juris Feudalis,' Jenæ, 1727 and 1737, 8vo.; 'Kurtzer Entwurff zur Einleitung zur Wissenschaft der Staaten von Deutschland,' Jenæ, 1733, 8vo. (the title of this work contains the term 'scientia statistica,' the invention of which has been attributed to Achenwall); 'Corpus Juris Gentium, sive Jurisprudentia Heroica ex Juris Naturæ et Gentium Argumentis petitum, et innumeris exemplis ex actis publicis editis et ineditis, historiarumque monumentis, omnis ævi illustratum' (this work occupied thirty years of its author's life, was left complete, but unpublished, at his death, and appeared at Jena in 1743, edited by J. Aug. Heifeld).

Much of the reputation of Burkhard Gotthelf Struve during his lifetime seems to have proceeded from his personal amiability, and from his usefulness as a general index. His style is heavy, and his thoughts scarcely ever original or striking. His services to the literature of history and jurisprudence are great, but they are mainly the services of an able librarian and index-maker. To him perhaps rather than to Achenwall belongs the merit of having given a more systematic form to the statistical branch of education as taught in the universities of Germany—an important department of information, but too apt to spread out into trivial diffuseness.

(*Nova Acta Eruditorum*, anno 1740 publicata, Lipsiæ, 1740; *Ad Nova Acta Eruditorum quæ Lipsiæ publicantur Supplementa*, Tomus iv., Lipsiæ, 1742; *Pii Manes Struviani, sive de Vita et Scriptis G. A. Struvii*, Jenæ, 1705; *Bibliothèque Germanique*, tomes viii. et xliii., Amsterdam, 1724 and 1738; Martini Lipenii *Bibliotheca Realis Juridica*, Lipsiæ, 1757.)

STRY, THE CIRCLE OF, in the kingdom of Galicia, is bounded on the north and north-east by that of Brzezan; on the south-east by that of Stanislawow; on the west by that of Sambor; and on the south by the kingdom of Hungary. Its area is 2170 square miles, and the population is probably not much under 220,000, of whom 13,000 or 14,000 are Jews. The whole circle is mountainous, and it is only on the north-east and north-west sides that there are some small plains. The valleys between the mountains are however tolerably fruitful. The principal river is the Dniester, which however only flows through the north-east part of the circle; the Stry falls

into the Dniester near Zybaczow. There are numerous small rivers and torrents. Agriculture is not carried on to any great extent; the inhabitants grow however corn, rye, barley, and oats, and a considerable quantity of potatoes and flax. The forests are extensive, and the consumption of wood is very great, partly for the salt-works, and partly for the iron-forges. Hassel observes that the number of cattle of all kinds was small, there being in 1817 only 4146 horses, 29,935 oxen, 35,392 cows, and 29,935 sheep. An official table for 1830 shows a very great increase, except in the number of sheep, viz. 10,544 horses, 47,491 oxen, 44,629 cows, and 21,921 sheep. There are no manufactures.

Stry, the capital of the circle, is situated in a tolerably fertile and well cultivated country, on the left bank of the river of the same name, over which there is a wooden bridge. It is surrounded with walls and ditches, and is one of the best towns in Galicia: about half of the inhabitants are Jews. The population is about 6000. There are one Roman Catholic and one United Greek church, a synagogue, a castle, and several schools.

(Blumenbach, *Gemälde der Oesterreichischen Monarchie:* Anonymous, *Historisch-Statistischer Umriss von der Oesterreichischen Monarchie; Oesterreichische National Encyclopädie.*)

STRYCHNIA, a vegetable alkali obtained from the *Strychnos Nux-vomica*, in which it exists combined with the Igasuric or Strychnic acid. Its properties are, that it is colourless, inodorous, crystalline, unalterable by exposure to the air, and extremely bitter. It requires more than 6660 times its weight of cold water, and 2500 times of boiling water for solution. It is insoluble in absolute alcohol or in æther, but in diluted alcohol it is to a certain extent soluble, and the solution by spontaneous evaporation yields crystals in the form of the octohedron, and of a square prism terminated by four-sided pyramids.

It acts like other alkalis on vegetable colours, and neutralises and forms salts with acids. It is extremely poisonous; one-eighth of a grain is sufficient to kill a dog, and a quarter of a grain produces a decided effect upon a man. As usually obtained, which is by a tedious and complicated process, it is probably mixed with some *brucia*, another extremely powerful vegetable alkali.

It is composed of—

Sixteen equivalents of hydrogen	.	16 or	6·8
Thirty equivalents of carbon	.	180 ..	77·0
Three equivalents of oxygen	.	24 ..	10·2
One equivalent of azote	.	14 ..	6·0
Equivalent	.	234	100·

It is employed in medicine.

STRYCHNIC ACID. This acid, as already noticed, exists in the *Strychnos Nux-vomica* in combination with strychnia. It is soluble both in water and in alcohol, and has an acid rough taste; it produces no change in the solutions of the salts of silver, iron, or mercury, but precipitates those of copper, of a green colour.

STRYCHNOS (from στρύχνος), a name applied by Theophrastus and Dioscorides to a kind of nightshade, and adopted by Linnæus for a genus of plants belonging to the natural order Apocynaceæ. This genus has been made the type of a distinct order by Blume, who has been followed by Link, D. Don, and others. The principal difference that it presents from the order Apocynaceæ, to which it is referred by Von Martius, Brown, and Lindley, is in its peltate seeds and simple succulent fruit. This genus is composed of trees or shrubs, which do not yield a milky juice, and have opposite usually nerved leaves and corymbose flowers; some of the species are possessed of tendrils, and are climbing plants. The calyx is 5-parted; corolla tubular, funnel-shaped, with a 5-parted spreading limb, which is valvate in æstivation; the stamens are 5, inserted into the throat of the corolla; ovary 2-celled, with a single style and capitate stigma; fruit a berry, pulpy inside, with a hard rind: seeds peltate, numerous, attached to a central placenta, with copious albumen, and foliaceous embryo. The species are not numerous, and are found principally in the tropical parts of Asia and America. One has been described by Mr. Brown a native of New Holland.

Strychnos Nux-vomica, Poison-nut or Ratsbane, is characterised by its oval shining leaves 3-5 nerved, and its round smooth berries containing many seeds. The flowers are small, and of a greenish-white colour, and are arranged in terminal corymbs. The fruit, when ripe, is of the size and colour of an orange. Although the seeds of this plant yield an alkaloid, which is a deadly poison, the pulp of the fruit is greedily eaten by many kinds of birds. The wood of this plant is very hard and durable, and on that account is applied to many purposes by the natives on the coast of Coromandel and other places where it grows. For the medical properties of this plant, see the article on that subject.

S. potatorum, Clearing-Nut, has ovate or oval glabrous pointed leaves; a deeply fissured bark, and berries containing only one seed. It is an abundant plant in the woods and mountains of the East Indies. It has shining fruit, which is black when ripe. When full grown, it attains a height of from 15 to 20 feet, and, like the last species, has a very hard wood, which is used for various economical purposes. The English name is derived from the use which is made of the seeds, which, when dried, are sold by the natives for the purposes of clearing muddy water.

S. St. Ignatii, St. Ignatius's Bean, has ovate acute glabrous leaves; pyriform fruit with many seeds, and 1-flowered axillary peduncles. It is a climbing shrub, without tendrils, bearing long drooping white flowers, which have the scent of jasmine. This species is the *Ignatia amara* of Linnæus, but has been referred to the present genus by later botanists. It is a native of Cochin-China, the Philippine Islands, and other parts of Asia. This plant is called *Papeeta* in India, and is used by the native doctors as a remedy in cholera, but is administered in conjunction with Jehiree (*Cocos Maldirica*). When given in overdoses, the symptoms are those of poisoning by strychnia, as vertigo, convulsions, &c., and the remedy used for these effects is lemonade in large quantities, which is said to afford relief speedily.

S. colubrina, Snake-wood, or Snake-poison Nut, is a climbing plant with simple tendrils; leaves oblong or oval obtuse, 3-nerved, shining; ovaries many-seeded. It is a native of the coast of Coromandel and of Silhet. It has small greenish-yellow flowers, and fruit as large as an orange, of a yellowish colour. It is called by the Telingas *Naga Musadi*, and is considered by the Indian doctors as an effectual remedy for the bite of the *Naga* or *Cobra de Capella*, a well-known poisonous snake. For this purpose it is used both externally and internally. It should however be stated as the result of the observation of the most intelligent travellers, that these vegetable remedies are not to be depended on in cases of bites of serpents, and that where danger is apprehended, the only effectual remedy is excising the wound. The wood of this and other species of the genus is brought to this country, and known under the name *Lignum colubrinum*.

S. Tieute, Tjettek or Upas Tieute, has elliptical, acuminate, 3-nerved, glabrous leaves, and simple tendrils, which are thickened opposite the solitary leaves. This plant is a climbing shrub, and is a native of Java, and is said to be the true Upas-tree of that country. It is undoubtedly the most poisonous species of the genus, and yields the greatest quantity of strychnia. There are several other plants which are called by the name of Upas in various parts of Asia. The natives of Java prepare from this species one of the most deadly of the various poisons that are used by barbarous nations, for producing death by the wounds occasioned by their arrows.

S. toxifera, Wooraly, *Urari*, or Poison-plant of Guiana, has a climbing stem, thickly covered with long spreading reddish hairs; coarse, rough, 5-nerved, ovate, or oblong, shortly acuminate leaves; large round fruit. This plant is a native of Guiana, and was lately brought to this country by Mr. Schomburgk. It had long been suspected that the poison used by the American Indians for their arrows was a species of Strychnos, but such is the secrecy with which they gather the plant and prepare the poison, that all inquiries had been frustrated. Mr. Schomburgk's long stay in Guiana has enabled him to decide this point: by bribing some of the natives, he induced them to guide him to a spot where their famous Urari flourished, and on arriving at the place, found it to be the species of Strychnos above described. In the preparation of the poison, the Urari is not the only ingredient, but forms about half of the bulk of the ingredients used. For a full account of the discovery of this plant, and the mode of making the poison, with its effects on the animal economy, the reader is referred to Mr. Schomburgk's account of the Indian arrow-poison.

(*Annals of Natural History*, vol. vii., p. 407.) It is remarkable that the poison prepared from this plant, though destroying life so rapidly when applied to a wound, may be taken into the stomach in doses of several grains without producing any ill effects, and it has even been proposed as a remedy in many diseases. It must be admitted however that it is a dangerous remedy to administer, as by coming in contact with the slightest abrasion of surface or ulceration, it might immediately destroy life.

S. pseudo-quina, Quina do Campo, has short-stalked, ovate, quintupled-nerved leaves, which are callous at the edge and smooth, or nearly so, above. It is a native of Brazil, and forms a scrubby plant about 12 feet high, with a corky bark. Its fruit is a smooth shining berry of a yellow colour, containing only four seeds. This plant is not poisonous, and is remarkable for its bitterness, which gives it a resemblance to the gentians and cinchonas. The fruit of this species is eaten by the native children. The fruit also of a species, *S. brachiata*, is eaten by deer in Peru, and that of *S. spinosa*, a Malagash plant, is greedily devoured by swine.

STRYCHNOS NUX-VO'MICA, *Medical Properties of.* The genus Strychnos, consisting of about twelve species, is remarkable for containing among these some which possess only mild or beneficent properties, while others are endowed with more potent and destructive powers than almost any other members of the vegetable kingdom. This extraordinary difference is presumed to be owing to certain species containing only an extractive, which is tonic and febrifuge, while others contain one or two alkaloids, which are extremely poisonous. This is true as far as the S. Nux-vomica, S. Ignatia, S. Colubrina, and S. Tieuté are concerned, all of which contain either *Strychnia* or *Brucia*, and some both of these alkaloids; but it does not apply to the S. toxifera (Schomburgk), in which no alkaloid has been detected. It must be admitted however that the S. toxifera, though equally fatal with the others, produces death in a different way. Those possessed of an alkaloid destroy life by exciting *tetanic spasms*, while the *wourali*, or *worary*, or [illegible] (prepared from the S. toxifera), produces diametrically opposite effects, as the muscles of voluntary motion are *paralysed* by it. The only species strictly officinal is the *nux-vomica*, *poison-nut*, or *ratsbane*, of which the seeds are employed, and to this attention shall be at present confined.

Strychnos Nux-vomica is a native of Coromandel, Malabar, Ceylon, and other parts of India, growing in sandy places, and attaining the size of a tree, but short, crooked, and sometimes twelve feet in circumference, flowering in the rainy season. The fruit is about the size of a St. Michael's orange, with a bitter astringent pulp, and containing (according to Sir Whitelaw Ainslie) from three to five seeds. The pulp may be eaten, but the seeds are poisonous and officinal; each seed is flattish, or very slightly concave on the side of the umbilicus, convex on the other, thickened at the margin, peltate, about three lines in thickness, and clothed with dense greyish, silky, or velvety hairs, which towards the umbilicus are arranged in concentric circles. The testa or coat is thin, the nucleus white or greyish, hard, horny, or cartilaginous, bipartite or divided by a cavity in the centre: the embryo is near the margin of the seed, and its position is often indicated by a prominent point.

Owing to the hard cartilaginous nature of the seeds, they are extremely difficult to reduce to powder or to slice. Different expedients are adopted to accomplish this. They may be exposed to the vapour of boiling water for two hours, then chopped or sliced, afterwards dried rapidly, and ground in a mill; or they may be boiled in an iron kettle with a small quantity of water, then dried and pounded; or merely steeped in water, sliced very fine, and then dried and pounded. Merck boils them in a close vessel for twenty-four or thirty-six hours with dilute sulphuric acid, by which they are completely softened. The mortar in which they are pounded, or the mill, should be kept covered, as the dust ascending may prove deleterious if inhaled. Old or mouldy seeds should be rejected, and consigned to the fire, but not thrown out, as they are destructive to pigs and other animals. Their freshness and excellence may be judged of from the whiteness of the interior when sliced. The entire seed is devoid of odour, but the powder has a peculiar one, somewhat resembling liquorice: the taste is nauseously bitter. Nux-vomica should never be purchased in the state of powder, as it is frequently adulterated with common salt or even emery-powder.

In Tobago an oil is expressed from the fresh seeds, which is used for burning.

The best analysis of the seeds of nux-vomica is by Pelletier and Caventou (*Annales De Chimie et Physique*, x., p. 142), who found—

Strychnate (or igasurate) of strychnia, 0·4 per cent.; strychnate of brucia; wax; concrete oil; yellow colouring-matter; gum; starch; bassorin; woody fibre; carbonate of lime and chloride of potassium, in the ashes.

It is on the strychnate of strychnia, and, in a less degree, on that of brucia, that the active properties of nux-vomica depend. Strychnia can be separated and purified by the process given above. [STRYCHNIA.]

Five pounds of the seeds yield sixteen ounces of a watery extract, and ten ounces of an alcoholic extract, which however always contains some green concrete oil soluble in æther.

Nux-vomica seems to exert a deleterious influence alike over vegetables and animals; there is however a difference of susceptibility to its action in different classes of animals, since a much larger quantity is necessary to destroy herbivorous than carnivorous animals.

The degree of effect varies with the quantity employed, but it seems to be the same in kind, being confined to the ganglionic system of nerves and the spinal chord, extending as high up as the medulla oblongata, and, according to Flourens, influencing even the cerebellum, but certainly not directly affecting the cerebrum. Hence in fatal cases the intellect is not disturbed till the extinction of life. The decapitation of animals does not hinder the characteristic action of nux-vomica, while, on the opposite hand, the removal of the spinal-marrow completely prevents its peculiar agency, even though artificial respiration be maintained. From some experiments of Segalas, it appears also to exhaust the irritability of the heart; for in animals he found that organ could not be stimulated to contract after death, and life could not be prolonged by artificial breathing. Nux-vomica differs from all narcotic poisons, by not exhausting the sensibility. During the intervals of the fits the sensibility is on the contrary heightened, and the faculties acute.' (Christison.)

Three distinct degrees of action may be observed from the use of nux-vomica. In small doses the ganglionic system appears chiefly to be affected, and this so slightly, that any phenomena are observed only in cases of disease, particularly in hysterical and weak persons. The secretions are increased, both of the intestinal canal, the liver, the kidneys, and of the skin, accompanied with an increase of appetite and improved digestion.

It is in the second degree of action that the characteristic effects of nux-vomica begin to appear. The patient experiences a feeling of weight and weakness in the movements of the limbs, inducing him to remain at rest: while his mind is restless, sad, depressed, and anxious for solitude and darkness, as he is peculiarly sensitive to light, noise, or the movement of the surrounding objects. With an augmentation of the dose, these phenomena are increased, and the contact of any external body causes a feeling like an electric shock, the voluntary muscles are no longer under the control of the will, and the individual staggers on the least attempt at walking. At the beginning of these occurrences the pulse is hard and quickened; the gums, cheeks, and eyes reddened, and the respiration more frequent; but when the nervous system is more affected, the hardness of the pulse subsides, the countenance becomes of an ashy paleness, the eyes appear sunken, articulation is difficult and indistinct, breathing is laborious, and accompanied with violent spasms of the larynx, and the other muscles of respiration are irregular in their action. After these symptoms have lasted six or twelve hours, they subside, and a great increase of the secretions is observed to follow; itching of the skin, with much perspiration, even accompanied with an eruption of vesicles or large blebs: the secretions of the serous membranes, of the kidneys, and of the mucous membranes, are sensibly increased, those of the latter sometimes becoming bloody. During this period the patient complains of heat in the stomach and throat, of thirst, of foul taste, and rancid eructations, with nausea, and occasionally even vomiting. While the augmented secretions are taking place, the more prominent nervous symptoms disappear: and in a few days the sufferers recover entirely from the debility and excessive sensibility.

The third degree of action manifests itself by tetanus and

asphyxia, occurring in single paroxysms, alternating with paralytic torpor. The paroxysms become longer, and the remissions shorter, in which however, till death close the scene, the intellect remains unaffected. While the voluntary muscles are entirely withdrawn from the control of the will, the pulse sinks and becomes slower, the breathing more and more laborious ('the external muscles of the chest may be felt during the fits as hard almost as bone; and, according to an experiment of Wepfer, the diaphragm partakes of the spasm of the external muscles:' Christison). The belly swells and exhibits blue marks, the countenance is livid, and in a paroxysm of tetanic rigidity the breathing ceases, though the heart's action and the peristaltic motion of the intestines continue for some time; and, if an artery be opened, black carbonaceous blood issues. 'Death however does not always take place by tetanus: in some cases the departure of the convulsions has been followed by a fatal state of general and indescribable exhaustion.' (Christison.) Thus after the spasms have lasted twelve, sixteen, or twenty-four hours, and completely disappeared, the individual has nevertheless died, after being apparently in a state of safety. This has been ascribed to the depressing effect on the heart's action, through the medium of the nervous system, of long continued pain (Alison's *Pathology*); or more probably, according to Dr. Marshall Hall (*Diseases of the Nervous System*, and *Gulstonian Lectures*), to what he terms *secondary asphyxia*. Or the individual may suffer an attack, after the primary symptoms have subsided, of inflammation of the stomach and intestines, which may or may not prove fatal.

Vomiting does not always occur, though the name would seem to imply the frequency of this symptom.

Nux-vomica is important not only for its formidable properties, but for the illustrations it furnishes to certain physiological doctrines. Thus when used in cases where a portion only of the body is paralysed, it excites convulsions in the paralysed part before any action be observed in the sound parts. 'The paralysed parts are the seat of tetanic shocks, of a prickly sensation, and of a perspiration, which is not observed elsewhere. In hemiplegia the sound side of the body remains tranquil, while the affected one is the seat of extreme agitation: the tetanic attacks succeed each other rapidly, and an abundant exudation takes place. Even an anomalous eruption has been observed, while the healthy side has been perfectly free. One side of the tongue is sometimes sensible of a decidedly bitter taste, which is not perceptible on the other. If the dose be augmented, both sides become the seat of tetanic action, though not equally so.' (Magendie.) It is also very remarkable that the contact of any external body with any part of the frame of an individual under the influence of nux-vomica which is supplied with nerves originating from the spinal chord, immediately excites convulsive actions. It is thus thought to support the notion of a distinct or *reflex function* of the spinal chord. (Marshall Hall's *Lectures on the Nervous System*: Grainger, *On the Spinal Chord*.) Certain it is that in persons poisoned by nux-vomica, whether the seeds or bark (false Angustura bark), the mere act of touching the skin to feel the pulse has excited again the convulsive motions. Of these two phenomena, viz. the action of strychnia on the paralysed limbs previous to causing any obvious effect on the sound organs, and of the contact of an extraneous body exciting the tetanic throes, the following explanation has been given by Mr. Grainger:—'Strychnia acts by preference on the paralytic limb or limbs, because the cerebral control is removed from the paralysed limb. If the chord be divided, the pure spinal power remaining, when the skin is touched the limb is retracted, and must be retracted, because the cerebral control is wanting. So when the spinal chord is stimulated by strychnia, it must act on the limb or limbs from which the cerebral power is withdrawn.'

Nux-vomica acts most rapidly when introduced into a vein, and in other instances in the ratio of the absorbing power of the part; but it produces no effect when applied directly to a nerve or to the brain.

In fatal cases the morbid appearances vary according to the period at which death occurs. When death results from asphyxia, the brain is gorged with blood, and the texture softer than natural. When death takes place at a late period, sometimes appearances of inflammation are found in the stomach and intestines; but frequently these are absent. A tetanic stiffness remains in the corpse, till decay commences: this state of rigidity however does not invariably occur.

The powerful properties of nux-vomica, and the rapidity of its action when administered in the state of a pure alcaloid, strychnia, or its salts, have deterred medical men from making so extensive a use of it as its therapeutic qualities entitle it to. The necessity for care in its administration is manifest from the facts, that death resulted, in one instance, merely from a woman grating cheese with a file which had been previously used to rasp seeds of nux-vomica; and in another instance, death ensued from three grains of the alcoholic extract taken at once. The consequence of a salutary dread of its being entertained has been that it is generally employed only as a last resource, instead of being used at an earlier period. It might however be beneficially used, with due caution and careful superintendence, in many cases of hysteria and hypochondriasis, dependent on irregular action of the nerves of the ganglionic system. In cases of hysterical paralysis, accompanied with greatly impaired sensibility, it would be more influential than any other agent in a disease at once tedious and distressing.

In paralysis it has been found more uniformly beneficial than most other remedies, though success has not always attended its employment. It is certainly better suited for some forms of paralysis than for others.

It is most serviceable in cases of paralysis of parts which derive their nerves from the ganglionic system or spinal chord. Hence it is more serviceable in *paraplegia* than in hemiplegia, in palsy of the bladder, of the rectum, and even in some cases of chronic diarrhœa dependent on atony of the intestines. It is more serviceable in the palsies which follow fevers, rheumatisms, repelled eruptions, habitual drunkenness, and exposure to noxious metals, such as lead or mercury, and merely depressed nervous power, than in those which result from effusion of blood. (See Dr. Bardsley's *Hospital Facts*.) Its use is altogether improper immediately after an apoplectic seizure and indeed whenever vascular fulness or organic disease of the brain is supposed to exist. Though less useful in affections of the nerves which arise from the brain, it has nevertheless proved beneficial in some cases of amaurosis, in which the endermic method of application has been employed, rather than the internal administration of it. Deafness has also been cured by it.

In the Asiatic or epidemic cholera it was of unquestionable service, though its use was generally postponed till a very late stage of the disease, instead of being employed at the commencement, when the premonitory diarrhœa could easily have been checked by it. When employed in paralysis of any of the limbs, an auspicious sign of its beneficial influence is a feeling of formication, and often of sweating, with or without an eruption, and spasmodic twitchings in the limb, while the rest of the body is unaffected.

Though nux-vomica is not, strictly speaking, a cumulative poison, yet it is prudent to suspend the use of it now and then, and upon resuming the employment of it, to return to a small dose, and not employ such a quantity as the patient had already taken; for it must be borne in mind that a person who has once been under its influence is more easily affected than a person using it for the first time.

It was conjectured by Batka, and it has since been proved by Dr. O'Shaughnessy, that the false Angustura bark [GALIPEA] was the bark of the Strychnos nux-vomica, so that in case of poisoning by that article, the same mode of treatment is to be pursued as in poisoning by nux-vomica or strychnia.

In cases of poisoning by nux-vomica, the most prompt treatment is necessary, and still more so if any of the soluble salts of strychnia shall have been taken. 'Nux-vomica is occasionally made the instrument of voluntary death, although no poison causes such torture.' (Christison.) The stomach-pump should instantly be had recourse to, when nux-vomica has been taken in powder, and as it adheres very obstinately to the coat of the stomach, it must be perseveringly used, with plenty of water. Emetics are too tedious in their action to be depended upon. M. Donné has recommended, when strychnia or any of its salts have been taken, to endeavour to form an insoluble salt; and for this purpose proposes chlorine, bromine, or iodine. The tincture of iodine may be procured promptly, but if ten minutes elapse before it be administered, it is unavailing. When the quantity of strychnia taken is not large, nor the symp-

toms very urgent, vital stimulants or sedatives are often sufficient, and for this purpose wine, brandy, or a mixture of acetous æther and laudanum, or laudanum alone, will remove the present danger. Conium or its tincture offers probable means of antagonising the action of strychnia, as suggested by Dr. Pereira. It is said that the leaves of the Feuillea cordifolia furnish an antidote to nux-vomica and several other vegetable poisons. It must ever be remembered that the danger is not entirely removed, though the spasms may have subsided, and the respiration become easy. Inflammation of the stomach may supervene, which will require the usual treatment, or secondary asphyxia may steal on, and destroy the patient. To prevent this last occurrence, great watchfulness is necessary, especially during the night, and the patient should be frequently awakened, and made to drink freely of green tea. But perhaps the most potent and efficient antidote to the other poisonous strychnias would be the urari poison of South America, as suggested by Mr. Morgan. (See Morgan's *Lecture on Tetanus*, p. 31.) The preparation of this substance, which has been an object of curiosity and interest since the time of Sir Walter Raleigh, has been fully detailed by Mr. Schomburgk. (*Annals of Natural History*, vol. vii.) It is an article of much importance to the natives of Guiana, as much of their means of subsistence depends upon their possessing this poison, in which to dip their arrows for the chase. They employ much mystery in its preparation, and pride themselves on its valuable properties, preferring it, with some show of reason, to gunpowder. 'I know,' said the *amo del curare* (master of poison, or Indian, who knows how to prepare it), 'that the whites have the secret of fabricating soap, and that black powder which has the defect of making a noise, and killing animals when they are wanted. The *curare*, which we prepare from father to son, is superior to anything you can make *down yonder* (beyond sea). It is the juice of an herb, which kills *silently* (without any one knowing whence the stroke comes).' (Humboldt, *Personal Narrative*, 2nd edit., vol. v., p. 517.) The chief if not the only active ingredient is the Strychnos toxifera (Schomb.), and perhaps, in some places, Strychnos cogens (Bentham), the other ingredients (most of which are obtained from climbing plants, lianes, or 'nebbees,' except one bulbous plant, a cissus, and another supposed to belong to the Xanthoxyleæ) are used only to bring the juice to a proper degree of consistency and adhesiveness. Arrows dipped in it have been known to retain their poisonous properties for twenty-seven years. (Iliff, in *Medical Gazette*, vol. xx., p. 261.) The poison when inspissated may be rendered liquid by heat, and is soluble in water, in alcohol, in hydrochloric acid, and in volatile alkaline spirit. It unites with acids without emotion or change of colour. If it be united with alkalis, no ebullition is observable, but it changes its colour from a dark-brown to a yellowish-brown. It possesses a remarkable influence over the blood, after it is taken from a vein. 'A few grains, mixed with as many ounces of human blood, warm from the veins, entirely prevents a separation of serum and crassamentum, and the whole mass continues in a state of fluidity similar to that in which it was drawn, until, after some days, it putrifies.' (Bancroft.) This property seems to point out the propriety of employing it in cholera, in which the separation of the serum from the crassamentum, while the blood was yet in the body, was one of the most remarkable symptoms of that disease. Dr. Hancock is of opinion that it is one of the most potent sedatives in nature, and, could it be safely managed, he had no doubt it might become a valuable remedial agent in the treatment of spasmodic or convulsive disorders. That there are means of controlling its action he was fully persuaded: and such, it appears, are adopted by the Indians of the Rio Negro and Amazon, who were constantly in the habit of shooting monkeys, birds, &c., and after bringing them to the ground, they took means to resuscitate them, and thus carry on a profitable trade with Grand Para and the Brazils. (*Medical Gazette*, vol. xx., p. 281.) The flesh of animals, birds, or fish which have been killed by these poisoned arrows, possesses no deleterious properties when eaten, but is thought to be more delicate than when killed by other means. Like the poison of the viper, which is only noxious when inserted into a wound, and which may be swallowed with impunity, the urari may be taken into the stomach with perfect safety. Its taste is an agreeable bitter, and it has a tonic and febrifuge effect, frequently proving a valuable cure in intermittents. It, as well as the venom of the viper, seems to be disarmed of its virulence by undergoing the process of digestion.

When inserted into a wound, shortly after a quantity of the 'tshittick' poison, prepared in Java from the Strychnos Tieuté (Upas Tieuté; see Sir Stamford Raffles's *History of Java*: Dr. Horsfield's *Plantæ Javanicæ Rariores*, part i., and *Annales de Chimie*, vol. xxvi.), it completely stills the convulsions excited by that active agent. (See Morgan's *Lecture on Tetanus*.) As the urari acts upon the brain, producing simple suspension of its functions, and a state of asphyxia by artificial respiration, this state may be recovered from, if the dose has not been too strong, and other circumstances are favourable. (See Brodie, in *Philos. Trans.*, vols. ci. and cii.)

The tshittick poison contains strychnia only, unaccompanied by brucia, and is therefore more rapid in its action than any other strychnos.

On account of the difficulty of preparing the alcoholic extract of nux-vomica of uniform strength, strychnia, or some of its soluble salts, is now generally substituted for it, as these admit of easy subdivision of the dose. Sulphate of strychnia has been used in some cases with great advantage (See Gaskoin, in *Med. Gaz.*, vol. x., p. 316); so also the acetate: but a form of preparation which has proved of service in some long-standing and almost hopeless cases of paralysis, is the hydriodate of strychnia. (See Magendie, *Formulaire*, 8ième edit., p. 144.)

Care must be taken that the strychnia be pure, as a spurious article is vended in France, which contains no trace of strychnia. Bichloride of mercury is a good test for strychnia, but it causes no precipitate from the solution of the acetate of strychnia; but the addition of hydrochloric acid causes a white crystalline precipitate. Sulpho-cyanodide of potassium appears to be the best test for strychnia. (See *British Annals of Medicine*, vol. i., p. 190.)

Strychnia is prepared either from the nux-vomica seeds, in which case it is difficult and expensive to separate it from the brucia, or it is obtained from the St. Ignatius Bean, in which it exists in about three times larger quantity than in nux-vomica. It is also, but rarely, procured from the Strychnos Colubrina. The purest and most easily obtained is furnished by the Strychnos Tieuté, but the rarety of this substance is a practical obstacle to its employment.

Snake-wood. Many substances, in countries infested with serpents, are reputed to be efficacious in counteracting the poisonous bites of these reptiles; one of the most celebrated of these is the root of the Strychnos Colubrina. The strychnia probably acts as an antagonist to the stupifying effects of the poison of the snake, just as arsenic does to the poison of the Coluber carinatus of the West Indies. [ARSENIC.]

Strychnos Potatorum, called also S. Tettan Cottay, or Clearing-nut, is a native of India, and is a larger tree than any other species. It is devoid of noxious properties. The fruit, though when very young it is made into a preserve, and eaten, is reckoned emetic by the native doctors. The chief use made of it is to rub the seeds hard for a short time round the inside of an earthen pot, into which water is poured, and in a short time it becomes clear, tasteless, and wholesome, however muddy, brackish, or putrid it may have been: hence its name of clearing-nut. Officers and soldiers, before setting off on a march, provide themselves with a store of these, as water purified by such means is deemed more wholesome than that clarified by alum. The bitter is in this case probably of use, as the inhabitants of Cairo render the muddy waters of the Nile quite clear and drinkable by rubbing bitter almonds on the inside of the earthen jars in which the water is kept. (Niebuhr's *Travels*, vol. i., pp. 71, 72.)

Strychnos Pseudo-china, Quina do Campo, or Field China, is a native of Brazil (St. Hilaire, *Plantes Usuelles de Bresil*, t. 1), and is devoid of strychnia or brucia. It is a remedy of the Sertaneias, being peculiarly fitted for those cases to which the true cinchonas are unsuitable. The taste is at first faintly aromatic, then astringent, and at last slightly bitter. It has no odour. In its properties it resembles Quassia, Menyanthes, or Gentian more than the true cinchonas with none of which, except the Maracaibo bark, could it readily be confounded in its physical characters. Mr. Burchell says, however, that even in the proper localities of the cinchonas many strychni are collected. [CINCHONA.]

STRYGOCEPHALUS. [Brachiopoda, vol. v., p. 312.]

STRYMON. [Amphipolis: Macedonia.]

STRYPE, THE REV. JOHN, is said to have been of German descent, but he was born in London, 12th November, 1643. After having been six years at St. Paul's school, he was admitted, in 1661, of Jesus College, Cambridge: but he soon after removed to Catherine Hall, where he took his Bachelor's degree in 1665, and his Master's in 1669. In the latter year he was presented to the perpetual curacy of Theydon-Boys in Essex; which however he resigned a few months after, upon being appointed minister of Low Leyton in the same county. Here he continued to reside till within a few years of his death, when he came to live with Mr. Harris, an apothecary at Hackney, who had married his granddaughter. He had been lecturer of Hackney till he resigned that appointment about the year 1724; and he also held along with his Essex living the sinecure of Terring in Sussex, to which he was presented by Archbishop Tennison. He died 13th December, 1737, in the house of Mr. Harris, at the great age of ninety-four.

The history of Strype's long life, in so far at least as it is of any public interest, consists merely of the list of his successive publications. Although his works amount to thirteen large folio volumes, besides octavos and pamphlets, it was not till he had reached his forty-sixth year that he gave any employment to the press, and then he began with a single sermon: nor did he print anything more till five years after. Then, in 1694, appeared, in a folio volume, the first fruit of his researches in ecclesiastical antiquities, his 'Memorials of the most renowned Father in God Thomas Cranmer, sometime Lord Archbishop of Canterbury.' This was followed, in 1698, by an octavo volume entitled 'The Life of the Learned Sir Thomas Smith, principal Secretary of State to Edward VI. and Elizabeth; wherein are discovered many singular matters relating to the State of Learning, the Reformation of Religion, and the Transactions of the Kingdom during his time;' that in 1701 by another octavo volume entitled 'Historical Collections relating to the Life and Acts of Bishop Aylmer' (or Aelmer, who filled the see of London from 1577 to 1594); and that by his 'Life of Sir John Cheke,' 8vo., London, 1705. He published another single sermon in 1708; and the next year he brought out the first volume in folio of his 'Annals of the Reformation and Establishment of Religion,' comprehending the first twelve years of the reign of Elizabeth. Before proceeding further with this work, he produced three more biographical folios as companions to his Life of Cranmer: his 'History of the Life and Acts of Archbishop Grindal,' in 1710; his 'Life and Acts of Archbishop Parker,' in 1711; and his 'Life and Acts of Archbishop Whitgift,' in 1718. Then, digressing to another field of antiquarian investigation, he came forth, in 1720, with his new edition of Stow's 'Survey of London,' in two bulky folios, of which we may safely say that nearly three-fourths consist of his own additions. [Stow.] The next year, 1721, was published what may be regarded as his most important work, his 'Ecclesiastical Memorials, relating chiefly to Religion and the Reformation of it, and the Emergencies of the Church of England, under King Henry VIII., King Edward VI., and Queen Mary I.' in three volumes, folio. Of this work a new edition, though limited, we believe, to a very small number of copies, was brought out at London in 1816, in seven volumes, 8vo. But Strype's labours were not yet closed: another single sermon, in 1724, ushered in a second edition of the first volume of his 'Annals' in 1725; a second folio volume of that work the same year, bringing down the history of the Church of England to A.D. 1580; a third in 1728, embracing the period from 1581 to 1588; and a fourth, in 1731, consisting however only of a collection of papers, which the author's advanced years and infirmities prevented him from reducing into a narrative, in illustration of the remainder of the reign of Elizabeth.

Strype probably spent the first fifty years of his life in collecting the materials of the voluminous works which he gave to the world in the succeeding forty. His books all consist for the greater part of masses of original papers, even so much of them as has the form of being his own composition scarcely ever evincing any real digestion of the facts which he sets before his readers. He claims the merit of great fidelity and accuracy, and probably he may be trusted in general for the correctness of his transcriptions, all of which he professes to have made with his own hand; but, being really what may be called a dull, almost a stupid man, though possessed of a considerable amount of knowledge, he is both apt to miss the essence of events and transactions in his prolix detail of the circumstances, and even occasionally, with all his tediousness, to leave his narrative imperfect by the omission of some particulars which would not have escaped a sharper intellect. We believe every reader or consulter of Strype will have found himself annoyed occasionally by this absence, amid a multitude of superfluities, of the one thing needful. His books however are all curious and valuable for the quantity of information they contain never before published, and not to be elsewhere found; and they must on that account be considered as forming, along with Burnet's 'History,' and even in some respects in a higher degree than that, the foundations of the history of the reformed Anglican church.

STUART FAMILY. The origin of this family is briefly stated under Robert II. of Scotland; and the list of kings of Scotland of this family, from Robert II. of Scotland to James VI. of Scotland and I. of England, is given in the article Scotland. The Acts of Settlement, passed in the reign of William III., secured the succession of the House of Hanover to the throne of England, and the descendants of James II. were subsequently excluded from the throne of Scotland also. [George I.] The chief historical interest that attaches to the House of Stuart after the abdication of James II., is limited to the two invasions of Great Britain by his son and grandson, who are often respectively called the elder and younger Pretender.

Stuart, James Francis Edward. On the 16th of September, 1701, James II. died: and his son James, Prince of Wales, was immediately acknowledged by Louis XIV. as king of Great Britain, contrary to his promise to King William. The king of France was induced, as Tindal affirms, to take this step, chiefly by the persuasion of Madame de Maintenon, whom Mary of Este had engaged in her favour; and the influence of the Dauphin was added to that of Madame de Maintenon. The king of Spain, the pope, and the duke of Savoy also acknowledged the Pretender, as the Prince of Wales was afterwards called, as king of England.

In 1708 extraordinary preparations were made by Louis XIV. at Dunkirk, but the object of them was kept so secret, that no one in England suspected the intentions of the French. Louis, indignant at the recent attempt of the allied powers upon Toulon, and believing that the discontent of the Scotch with the Union rendered them ready for revolt, was preparing to invade England. The Pretender's claims were the ostensible reason for this attempt; and Louis, in a visit to him at St. Germain's, presented him with a sword mounted with diamonds, begging him never to forget that it was a French sword. The prince repaired to Dunkirk, intending to pass over to the Frith of Forth; but he was taken ill of the measles, and the English fleet had time to get ready. 'In the meantime,' says Cunningham, 'the Pretender wrote to the French king for his directions what to do in this unhappy case. The French king, who was no more concerned about the Pretender's life and affairs than to serve his own turn, answered, that he must not desist from the undertaking nor delay his embarkation; and ordered some men thither to see him on ship-board, though he was hardly recovered of his distemper.' So eager was Louis for the enterprise, that though the Pretender requested only a few days for the recovery of his health, Louis was peremptory, and the fleet put to sea. But this expedition was wholly unsuccessful, partly, as some thought, from the aversion of the Pretender to land in Scotland, partly from storms, which dispersed the French ships, partly from the vigilance of the English admiral, Sir George Byng, but chiefly from the dissensions of Fourbin and Gare, who had the command of the French fleet. It returned, with the Pretender on board, to Dunkirk, and the disappointed prince obtained permission of Louis to engage in the campaign in Flanders. In commemoration of this expedition a medal was struck in England; and the price of 100,000 crowns was set upon the Pretender's head by the English parliament. On the 11th of July, 1708, the Pretender is stated by French writers to have been in the battle of Oudenarde, which was gained by Marlborough; but according to the accounts of Dutch historians, he contented himself with observing the engagement from the steeple of a neighbouring village, and consulted his safety by a timely retreat.

In 1713 the Pretender published a protest which he forwarded to the ministers of the different states at Utrecht,

claring that he could not 'by his silence seem to consent what was transacting to the prejudice of him and of the wful heirs of his kingdom;' and that, finding the confede-te powers had no regard to his rights, he solemnly pro-sted against all that might be agreed on to his prejudice. o notice was publicly taken of this protest; but the Pre-nder's friends in England were indefatigable in strength-ning his favour with the queen. The jealousy which Anne erished of the House of Hanover, and her resentment hen it was proposed that the Electress Sophia should re-de in England, strengthened for a time the influence of ord Bolingbroke. But the Pretender's stronghold was the affections of the queen. It has even been surmised hat she was cognizant of the expedition against Scot-and in 1708. Upon the death of Queen Anne, James, ho had been residing at Bar-le-duc, posted to Versailles, where he met with an ungenerous reception from Louis XIV., who had found it most consonant with his in-erests to acknowledge King George I., and who intimated o the Pretender, through the Marquis de Torcy, that he must quit France. In August, 1714, James sent to the rincipal nobility of Great Britain a declaration in which e asserted his claim to the throne, and stated his surprise hat upon the death of the queen a foreign prince should ave been proclaimed king. This manifesto was sent by many of those who received it to the secretary of state; and the ambassador of the duke of Lorraine, in whose territory James was then living, was forbidden the court. A pro-clamation was made, in which the price of 100,000*l.* was set on the head of the Pretender, who, as his partisans ex-pressed it, had 'no place left for him to flee unto.' Cir-cumstances however had been operating in favour of the Pretender. Many persons had an hereditary attachment to the House of Stuart; some were influenced by hopes and promises of honours; and more, by the outcry that the church was in danger under the Whig government, which was 'the main artifice' of the plot, as George I., in his speech to parliament, after the rebellion had commenced, expressed himself. In 1715 the court of St. James's received in-formation that an open rebellion had broken out in Scot-land, headed by the earl of Mar, who had been secretary of state for Scotland when Anne died, and had been one of the first to swear allegiance to her successor. The mar-quisses of Huntley and Tullibardine, the earls of Southesk and Marischal, with many other noblemen and landed pro-prietors, joined in the rebellion, and the Pretender's stan-dard was set up by the earl of Mar at Brae-Mar, on the 6th of September, 1715.

Active measures were taken by the English government. Several suspected persons were imprisoned in the castle of Edinburgh; and General Whetham was ordered to form a camp near Stirling. Several vessels at the same time sailed from Hâvre-de-Grace for Scotland, and notwithstanding the efforts of the British navy, one of them reached Ar-broath, and supplied the Highlanders with arms and am-munition, which were carried to Brae-Mar. Assurances were also given that the Pretender would shortly arrive. But the news that Louis XIV., who had secretly encouraged the rebellion, was dead, struck a panic among the Jacobites, and for a time suspended their operations. They decided however to proceed in their course, and to urge the Preten-der by letter to appear amongst them. The earl of Mar as-sumed the title of lieutenant-general of the Pretender's forces, and a manifesto, setting forth the national grievances, was published. A scheme was also formed to surprise the castle of Edinburgh, but was defeated.

About the 9th of September the duke of Argyle, com-mander-in chief of the English forces in Scotland, marched northward; whilst several Scottish peers, the earl of Su-therland, the duke of Roxburgh, and others, showed their loyalty to King George by raising their clans. A con-spiracy was about the same time discovered in England. Colonel Paul, who had a company in the first regiment of foot-guards, was detected in enlisting men for the Pre-tender's service. In Somersetshire an insurrection was projected, but checked by the government; treasonable designs however were so widely spread in the western counties of England, that at Bath the Jacobites talked openly of the Scotch rebellion as merely a diversion to draw the troops off to the north. General Wade was at last ordered to march to Bath, where he discovered and seized many chests of fire-arms and some pieces of cannon. The university of Oxford was also tainted with Jacobitism, and 'King James's' health is reported to have been drunk there every day. General Pepper being dispatched to Oxford, entered the city early one morning and apprehended six-teen or eighteen persons, whom he conveyed to Abingdon. Cornwall was also disaffected, and a correspondence was now carried on among the conspirators throughout Great Britain. As their communications could not with safety be entrusted to the post, Jacobite gentlemen rode to different parts of the kingdom under the pretence of travelling for pleasure, but in fact to convey letters and intelligence.

The next step which the insurgents took in the north was to proclaim James king at Newcastle-upon-Tyne, and to make an attempt on the town of Newcastle, but finding the gates closed, they retired to Hexham, where they were joined by some Scottish horse. Their numbers were now increased by recruits, who joined them at different towns, and the influence of the earl of Derwentwater, a Jacobite nobleman, gave them additional strength. But the town of Newcastle stood firm, and the rebels, hearing that they were to be attacked at Hexham, withdrew from that place, having first proclaimed the Pretender. On the 12th of Oc-tober the standard of James VIII. of Scotland was set up at Moffat in Annandale, by the earl of Kenmure; and on the 19th the Scots, under Lord Kenmure, being joined by the English rebels, marched to Kelso.

In the meantime the earl of Mar proceeded to Dunkeld, where the marquis of Tullibardine, and the earl of Bread-albane, joined his troops with 2000 men. They possessed themselves of Perth, and upon this important town being gained, their force was much augmented. The rebel army now assumed a formidable appearance; being the clans-men of rich nobles and chiefs, the soldiers were well armed, and amounted to 12,000, cavalry and infantry. The rebels possessed themselves of Brunt Island, and afterwards of all the towns on the coast between their head-quarters and the mouth of the Firth of Forth. The earl of Mar next attempted to cross the Firth, and to make a descent upon the Lothians, in order to gain over the south of Scot-land. Fifteen hundred men succeeded in landing at North Berwick, Aberlady, and other places. Their next attempt was to march to Edinburgh, where they expected to be joined by the people; but the duke of Argyle sending a detach-ment to prevent their entrance into the capital, the rebels changed their course, and marched into Leith. They then retreated to Seaton House, an old castle about seven miles from Edinburgh, whence the earl of Rothes, with a com-pany of dragoons and volunteers, finding it impossible to dis-lodge them without artillery, was obliged to retire.

On the 27th of October the Highlanders at Seaton House marched southwards to Kelso, where they were joined by the English and Scottish horse from Nithsdale and Northum-berland. Mr. James Murray had arrived in Edinburgh, authorised to make liberal promises of assistance from France, and to declare that he came in the capacity of se-cretary to the Pretender. It was now expected that all com-munication would soon be cut off between the duke of Argyle and London; and the earl of Mar was strongly advised to attack Argyle before the arrival of a reinforcement of dra-goons from Ireland, which were expected.

It was now that the 6000 men guaranteed by the Dutch to be sent over to England were demanded by the British ministry, and granted by the States. Orders were issued to all the governors of seaports to examine all British sub-jects who might attempt to pass from the Continent into England; for it was thought that the Pretender, with the duke of Ormond and Viscount Bolingbroke, intended to come into the country. On the 25th of October General Carpenter set out from Newcastle for Kelso, where the Ja-cobite army lay. The Jacobite commanders proposed to pass the Tweed and attack Carpenter's troops, which were tired with marching; but ultimately the Pretender's forces marched to Jedburgh, and thence towards Dumfries, which they thought of investing. The duke of Argyle was at Stir-ling with so small a force, that unless he was soon joined by the Dutch or Irish troops, he could not save Dumfries. Every thing seemed to favour the enterprise of the Pretender, but divisions in the Jacobite council of war frustrated their plans. The earl of Wintoun, one of the insurgent leaders, opposed the siege of Dumfries, and the English officers urged a march into their own country. Confidence was thus lost, and the men daily deserted. After some loss of time the rebels marched to Brampton in Cumberland, where the Pretender was proclaimed. They then proceeded to Penrith, and thence

on the 5th of November to Appleby; next to Kendal and Kirby Lonsdale, and on the 7th to Lancaster, which they entered without opposition. They left Lancaster on the 9th day of the month, for Preston, where they were joined by a number of gentlemen and others of the Roman Catholic persuasion, a circumstance which did not satisfy the Scottish chieftains and Highlanders, who had been led to expect that their forces would be augmented by the high church party.

General Carpenter was now pursuing the Jacobites, but with his dragoons only, in order to save time. He had communicated with General Willes, at Chester; and both generals advanced in concert, to unite their strength and attack the rebels at Preston. General Willes reached Preston first, and found the town strongly barricaded. On the 12th of November Willes attacked the barricade below the church, which was gained: but the other barricades, which were flanked with Highlanders, were not carried, and the king's troops were obliged to retire that evening. On the following morning General Carpenter and his troops arrived, and the town was completely invested. The Highlanders were indeed eager to make a sally, but they were not allowed to move. A capitulation was determined on, and Colonel Oxburgh went out with a trumpet to propose terms to General Willes. All however that he could gain was a promise that, if the rebels would lay down their arms, he would not allow the soldiers to cut them to pieces, and he would give them an hour to consider of it. No terms were finally made for the Jacobites. General Carpenter entered the town on one side, and General Willes on the other; and they met the rebel troops in the middle of the town. The noblemen and chieftains were put first under guard, and then their followers. The number of the English and Scottish prisoners of all classes amounted to 1459. On the same day that Preston surrendered, the battle of Dumblane was fought between the duke of Argyle and the earl of Mar. The left wing of the rebels, though they fought bravely, was routed; and the duke of Argyle, after pursuing them to the river Allan, returned to the field, where both armies stood looking at each other; towards evening the duke drew off to Dumblane, and the enemy to Ardoch. On the same day news arrived that the pass of Inverness was gained. This important advantage was the result of treachery. Lord Lovat had delivered it to the king's troops.

The principal persons among the rebels were sent to London. On reaching Highgate, they were pinioned with cords, and not allowed to hold the reins of their horses, which were led by a foot soldier. The prisoners were conducted from Highgate to London, amid crowds of spectators, the drums playing a triumphal march. They were distributed in different prisons; the noblemen were lodged in the Tower.

On the 22nd of December the Pretender landed at Peterhead in Scotland, with a train of six gentlemen, among whom was the marquis of Tynemouth, son of the duke of Berwick. From Peterhead James proceeded to Newburgh, a seat of the Earl Marischal's; and passing through Aberdeen in disguise to Fetterope, he was met there by the earl of Mar, who had left Perth with a troop of horse. James now assumed the state of royalty: he formed a court, and made several peers and created knights. He was also proclaimed with great ceremony before the house where he was lodging.

In January, 1716, the Pretender made a progress through the country, entering Dundee publicly, with the earl of Mar on his right hand, and the Earl Marischal on his left. The people thronged into the market-place to kiss his hand. On the 7th of January he arrived at Scone, and on the 9th of January he made his public entry into Perth, and reviewed some of the troops. He expressed great pleasure at the sight of the Highland dress, which was new to him. In the evening he returned to Scone, where he formed a council, and issued six proclamations. On the 16th of the month, James harangued his council, having previously received addresses from the episcopal clergy of Aberdeen. His council however, being convinced, after the arrival of the Dutch troops, that the army of the Pretender could no longer resist that of Argyle, had resolved to abandon the enterprise and disperse the forces. But wishing to keep their design secret, they acted as if they meant to attack the English army. They began to raise batteries, plant guns, and even destroyed Auchterarder, Blackford, Denning, Muthell, and other places, to prevent their affording quarter and provision to the enemy. The duke of Argyle, having received supplies, marched through Auchterarder, to Tullibardine, whilst the Pretender and his followers retreated to Dundee. Suspicions now arose that the Pretender, together with the members of his council, intended to escape, and to leave the army to their fate; and the report gained ground when the Jacobite army was ordered to march to Montrose, near which several French ships lay at anchor. The rebel troops, possessed with this idea, refused to move. The earl of Mar however succeeded in pacifying them, by the assurance that James was going to place himself at their head, and by declaring that it was intended to make a stand at Aberdeen; and to add to the deception, the horses and body guard of the Pretender were drawn out before the door of the house where he lodged. James, in the meantime, slipping out by a back entrance, walked to the earl of Mar's lodgings, and proceeded to the sea-shore, where a boat conveyed him and Lord Mar on board a French ship which was then in Montrose road. The boat returned, and fetched seventeen persons of rank, who were acquainted with the Pretender's design. The Pretender reached Gravelines in a few days. The vessel returned in twelve days: and, in spite of the utmost vigilance on the part of Argyle, a very considerable portion of the noblemen and others who were engaged in this unfortunate affair escaped to France.

In France, at this time, there was little comfort for the Pretender and his friends. It was the interest of the duke of Orleans, regent during the minority of Louis XV., to maintain a good understanding with the House of Hanover. Lord Stair, the English ambassador, was urgent in his remonstrances to prevent the Pretender's return to France. On his return from Scotland, James found it necessary to dismiss Lord Bolingbroke, who had acted as his secretary, on suspicion of treachery, and the place was filled by the duke of Ormond.

The earls of Wintoun, Kenmure, and Derwentwater, of Carnwath and of Nithsdale, with lords Widdrington and Nairn, were tried at London. The prisoners of inferior rank were tried chiefly at Lancaster, where many were executed: one thousand of them, upon their petition, were transported to the Plantations in North America.

The countess of Nithsdale and Lady Nairn, waiting their opportunity behind a window-curtain, threw themselves on their knees before the king, as he passed through the apartments of St. James's palace, to beg for their husbands' lives. The king heard their appeal, but was not moved. Lady Derwentwater, with the duchesses of Richmond and Bolton, were introduced by the dukes of Richmond and St. Albans into the royal bed-chamber, where Lady Derwentwater humbly besought mercy for her husband. On the 7th of March, the earls of Derwentwater and Kenmure were beheaded on Tower Hill: lords Widdrington, Carnwath, and Nairn were reprieved. The earl of Nithsdale escaped in woman's attire brought to him by his wife. The earl of Wintoun was condemned to death, but escaped from the Tower.

There were still however proofs of disaffection. On the 29th of May the Jacobites wore oaken boughs; and on the 10th of June, the Pretender's birthday, they displayed white roses. At Oxford the spirit of disaffection was shown more plainly than in any other place. Alarmed by these and other manifestations, in 1716, King George succeeded in forming an alliance with France and the States, the chief object of which was to crush the Jacobite cause. By this treaty it was stipulated that the Pretender was to leave France, and to go beyond the Alps; nor was he to be permitted ever to set foot in France again on any pretext whatever. A renewal of that promise which had been made at the treaty of Utrecht was given; and all protection was withdrawn from James on the part of the French government. The Pretender removed into Italy.

In 1718 the Pretender became the instrument of Cardinal Alberoni's ambitious intrigues. Upon war breaking out between France and Spain, James left Urbino, where he had resided since his expulsion from France, and went to Rome. He was there advised by pope Clement XI. to go into Spain, where a squadron had been for some time fitting out against England. James was received with regal honours at Madrid; and the duke of Ormond, one of his adherents, was appointed captain-general of the expedition which was to invade England, and was authorised to proclaim the Pretender's name at certain places. But a

storm dispersed and entirely disabled the Spanish fleet off Cape Finisterre; and a descent which the Spaniards made at Kintail in Scotland (June, 1719), although aided by the Highlanders, was defeated by General Wightman. During the year 1718-19 a marriage was agreed on between the Pretender and Maria Clementina Sobieski, grand-daughter of John Sobieski, king of Poland. This princess had a million sterling for her dowry. The court of Vienna however objected to the marriage; and on her way through Tyrol to Italy the princess was seized, and placed in confinement in Innspruck. Not being released, even upon the personal application of her father, she escaped from Innspruck in man's clothes, went to Bologna, and was there married by proxy to the Pretender, who was still in Spain. Two sons, Charles-Edward and Henry, were the offspring of this union. The earl and countess of Inverness were entrusted with the charge of the eldest, styled Prince Charles. They were Protestants, a circumstance which gave great offence to their mother, and to Cardinal Alberoni, by whose counsels she was governed. After six years of married infelicity, or, as Maria Clementina terms it in her letters, 'of injuries and insults,' she withdrew, in 1725, to the convent of Cecilia, whence no intreaties of her husband could draw her, nor could he for many months obtain even an explanation of her conduct. From various letters, which are given in the 'Lockhart Papers,' it seems that, as usual, both parties considered themselves in the right. The Pretender would not part with Lord Inverness: his wife was resolved not to return to him whilst that nobleman and his wife, of whom she is said to have been jealous, remained at court. The followers of James were scandalised at this breach; at length the earl of Inverness was dismissed, and a reconciliation was effected. The earl of Inverness was a Colonel Hay, upon whom the Pretender bestowed that title in 1725, at the same time making him his secretary. He was always called Colonel Hay, except at the Pretender's court, and by the persons corresponding with it. Maria Clementina died in 1735.

In 1722 the Pretender published at Lucca his famous declaration, addressed to his loving subjects of Great Britain, and to all foreign princes and states, to serve as a foundation for a lasting peace in Europe, and signed 'James Rex.' This document, which, amongst other articles, contained a proposal to George I. to resign his crown, was pronounced by the House of Lords to be a false, insolent, and traitorous libel, and was burnt at the Royal Exchange.

The death of George I. produced no improvement in the fortunes of James Stuart, though there were continual cabals in his favour in Great Britain, and a treaty (called the treaty of Vienna) had been formed between the emperor of Germany and the king of Spain in 1725, with a view of restoring the Pretender. James, during the latter years of his life, resided entirely at Rome, where he led a quiet life, although the hope of ascending the throne of England seems never wholly to have left him. Frugal in his household, he saved, out of the pension allowed him by the pope and his share of the Sobieski estate, a sum of money sufficient to defray the expenses of a subsequent invasion of England. The events of the year 1745 belong to the history of his eldest son, rather than to the annals of the Pretender's life. He was the last of the Stuarts that received kingly honours. James Stuart died at Rome in 1765. The character of the Pretender has been variously represented. 'He began the world,' says Lockhart of Carnwath, 'with the general esteem of mankind. Every person, friend or foe, allowed him to be a wise, sober, just, good-natured prince, of great knowledge and application in business; and such as knew him, both foreigners and subjects, concurred in portending the happiness of that people over whom he should rule, and this character he maintained whilst the earl of Mar was at the head of his affairs after their return from Scotland. . . . . But soon after Mar's removal, his majesty's character and affairs appeared in a quite different light; . . . . people soon saw that they were not carried on with the dexterity and secresy as formerly; but that which struck the nail on the head was his allowing those his favourites (which seems to be a curse in a peculiar manner entailed on the royal race of Stuart) to rule under him in so absolute arbitrary a manner, that the prerogatives of a sovereign and a husband were screwed up to a pitch not tenable by the laws of God or man, nor consistent with prudence.' (*Lockhart Papers*, vol. ii., p. 405.) Mr. Leslie a non-juring clergyman, who had opportunities of conversing with the Pretender, praises his affability, good sense, freedom from bigotry, and magnanimity. By the Whig party his temper has been generally represented as morose, sullen, and disposed to tyranny.

Charles Edward Stuart, born on the 31st of December, 1721, bore the title of Prince of Wales among the Jacobites. He served in Spain under Don Carlos, who paid him great respect and attention. He is represented, a few years after this time, to have been a youth of graceful person, generous, affable, and engaging manners, 'to have the spirit of a Sobieski without the timidity of a Stuart;' and, though reared in the effeminate south, to have been capable of encountering difficulties and hardships. In the year 1743 Cardinal Tencin, the prime minister of France, who had received the purple at the recommendation of the Pretender, combined with the Jacobites in England and Ireland to project a fresh invasion of Great Britain. He persuaded the Pretender to surrender his claims to Charles Edward, and, upon his consenting, the prince set out for France, giving out that he intended to make a campaign in Piedmont, but proceeding in the disguise of a courier to Paris, where he arrived on the 20th of January, 1744. The young man was, as Tindal expresses it, 'made a loan of to France,' whose aim was to cover her own selfish designs with the plea of countenancing the Stuart family. Marshal Saxe was appointed to command the expedition; and he, having been in England, and knowing that the towns were rarely fortified, had an idea that the country could be quickly subdued.

The young prince set out for the coast of Picardy, where an army of 15,000 men was assembled, and transports were provided at Boulogne, Dunkirk, and Calais for carrying the troops to England. The army was to land on the coast of Kent, where many Jacobites were expected to rise; and at the same time a squadron sailed from Brest to convoy the transports. But the squadron fled before the British fleet under the command of Sir John Norris, and almost shared the fate of the Invincible Armada. A violent storm destroyed most of the transports, and a great part of the troops were drowned. (1744.) The prince returned to Paris, and waited a more favourable opportunity. But he was not daunted by obstacles, and the period at which the rebellion of 1745 was undertaken was favourable to its success. The king of England was in Hanover, and Scotland was almost destitute of troops. The Highlanders, disaffected, and thirsting for revenge, were ripe for revolt. Towards the end of May, 1745, Charles Edward left Paris for Nantes. William, marquis of Tullibardine, who had been attainted in 1715, Sir John Macdonald, Colonel Strictland, Mr. George Kelly, a clergyman of the Church of England, and Sir Thomas Sheridan, formerly tutor to the young Pretender, with several other gentlemen, accompanied him. On the 5th of July he sailed in La Doutelle, a French vessel, which he had joined from Nantes in a fishing-boat, designing to sail round Ireland, and to land upon the western coast of Scotland. Another ship, the Elizabeth, was ordered to accompany him as a convoy, and on board this vessel the prince had placed 400,000*l.* sterling, with arms for several thousand men. These two ships fell in with a British cruiser to the west of the Lizard Point. A fierce action ensued, and the Elizabeth was so much damaged as to be obliged to put back into Brest. The prince pursued his course to Scotland, saying that he would either die or be crowned. On the 25th of the month he landed at Boradale, a farm belonging to Macdonald of Clanronald, on the shore of the bay of Lochnanuagh. He thence proceeded to the house of Kinlochmoidart, where he was met by several Highland chieftains; and whence the clans were summoned to rise. Many persons here advised the prince to return to France, and wait another opportunity; but he was resolute in remaining. About ten days afterwards the prince set up his standard at Glenfinnin.

At this time Sir John Cope was commander-in-chief in Scotland. At first the news of the rebellion was treated with ridicule, and the government were dilatory in their measures. On the 6th of August a reward of 30,000*l.* was offered, by proclamation of the lords justices in the Gazette, to any person who should secure the eldest son of the Pretender; and on the 31st, George II. returned to London from Hanover. The prince, having heard of the price put upon his person, issued a counter proclamation, offering 30,000*l.* for apprehending the elector of Hanover. On the 27th of August he advanced in hopes of meeting Sir John Cope, but on reaching Garvamore, he found that General Cope had faced about, and taken the route by Ruthven to Inverness. No sooner did the English troops

turn their backs upon the Jacobite army, than a common soldier deserted, and carried the news to the other side. The Highlanders instantly put themselves into motion; and on arriving at Garvamore, it was determined that they should march to the south, and enter the low country, thus endeavouring to get possession of Edinburgh before General Cope should arrive there. On the 30th of August they reached Blair Athol, and the duke of Athol, who was on King George's side, retired at their approach. On the 3rd of September they entered Perth, where the Pretender's declarations were read. At Perth great numbers flocked to the Pretender's standard. Among the most considerable were the duke of Perth, Lord Strathallan, and Lord George Murray, who was the younger brother of the marquis of Tullibardine, whose right of primogeniture had been forfeited by his attachment to the exiled Stuarts; his second brother, Lord James, now duke of Athol, having succeeded to his estates and honours. Lord George Murray was a brave, humane, and honourable man; and he possessed a sound judgment in military matters. Having accepted the act of grace which passed after the rebellion of 1715, Lord George was nevertheless not possessed of that entire confidence on the part of Charles Edward which he proved himself eventually to have fully merited.

The reception which the prince met with in the Lowlands was not so cordial as he expected. On the 11th of September he marched from Perth to Dumblane; and, on the 13th, passed the Forth at the ford of the Frew, a few miles above Stirling. Colonel Gardiner's dragoons, which were posted near Stirling, withdrew at his approach. On the 15th instant the rebels arrived within nine miles of Edinburgh, and Gardiner's and Hamilton's dragoons were posted within two miles of it. The city had been hastily fortified; a thousand men had been armed for its defence, in addition to the city guard; and trained bands of mixed Whigs and Jacobites were constantly on duty. Everything was so prepared that the town might have held out for some days before troops which had not a single cannon. 'But,' says an anonymous writer, 'to the lasting dishonour of Scotland, the capital was given up to a handful of half-starved savages, without stroke of sword.'

On the 15th of September, being Sunday, public worship was suspended, and the volunteers were under arms all day. On Monday, until noon, the defence was carried on very vigorously; but about two o'clock a petition was set on foot, praying the magistrates and town-council to call a meeting of the chief inhabitants, to deliberate concerning the propriety of delivering the town up to Charles Edward. About this time, the dragoons first, and afterwards the officers of the crown, left the city, the dragoons taking the route of Musselburgh and Haddington. The result of the public meeting, which was principally composed of Jacobites, was a determination to surrender the town, and place the arms of the volunteers in the castle. A deputation was dispatched to Gray's Hill, about two miles from Edinburgh, where Charles Edward then was. Whilst the terms of capitulation were still under discussion, intelligence came that General Cope had arrived at Dunbar, and would speedily march to the relief of the town. A second deputation was sent, to gain time; and those who composed it returned to the city early in the morning of Tuesday the 17th in a coach. The coach entered at the West Port, and drove down the street towards the Canongate. On the gate being opened, a body of 900 Highlanders, under the command of Lochiel and Sullivan, rushed in: the lord provost and town council, who were waiting the return of the deputation in the street, on hearing of this event, retired to their homes. At noon, Charles, in a Highland dress, attended by the duke of Perth and Lord Elcho, came by Duddingston into the King's Park, and entered through St. Anne's Yard into Holyrood Palace. There was a great crowd assembled to receive him, and the young prince was one whose personal appearance might seem to justify the enthusiasm which he inspired. 'The figure and presence of Charles,' observes Mr. Home, who witnessed his entrance to Holyrood, 'were not ill suited to his lofty pretensions. He was in the prime of youth, tall and handsome, and of a fair complexion.' As he entered the palace there was an expression of languor and melancholy in his countenance: the Jacobites compared him to Robert Bruce; the Whigs declared that he looked like a gentleman and a man of fashion, but not like a conqueror. After dismounting, the prince walked towards the apartments of the duke of Hamilton: when he was near the door, a gentleman moved out of the crowd, drew his sword, and walked up stairs before the prince. This was James Hepburn of Keith, who had been engaged when very young in the rebellion of 1715; a gentleman who is said to have been a model of manliness, simplicity, and honour; but whose hatred of the Union, rather than love of the Stuart race, induced him to sacrifice himself to a notion of national independence.

In the meantime Sir John Cope had marched from Dunbar to Haddington, and thence to Prestonpans and Seaton. A council of war had been held by Charles Edward at Duddingston, where he had proposed to engage General Cope's army. This was agreed on; but when the prince declared his resolution to lead the troops to battle himself, the chiefs remonstrated, and with some difficulty induced him to give up the design. On the next morning (Sept. 21) the Highlanders advanced to Tranent; and to the west of the town continued their march until they saw the king's soldiers encamped near Preston. A loud shout was raised by the English, and returned by the Highland troops. A morass, which was pronounced to be impassable, divided the armies. The afternoon was spent in movements. At night both armies lay down to repose, the Highlanders with the resolution of attacking the king's troops early in the morning. During the night, a country gentleman, who knew the ground well, proposed to Lord George Murray to show him a part of the morass whence the rebels might attack their enemies without observation. Lord George referred him to Prince Charles, who was sleeping on the ground with a sheaf of pease-straw under his head. Charles was pleased with the proposal, and before break of day his troops began to move. They marched through a sort of valley, or hollow, concealed by the darkness first, and afterwards by a mist. Charles took his place between the first and second line. At length the morass being passed, the two armies were separated only by a corn-field. The Highlanders, ill armed and without cannon, followed up the advantage which they had gained with wonderful success. A panic seized the king's troops. The Highlanders threw down their musquets, drew their swords, and pursued the enemy. 'In a very few minutes,' says Home, 'after the first cannon was fired, the whole army, both horse and foot, were put to flight. Not one of the soldiers attempted to reload their musquets, and not one bayonet was stained with blood.' All the king's infantry was killed, or taken prisoners, except about 170, who escaped by great speed, or other good fortune. This was called the battle of Prestonpans.

The second line of the Highland troops, commanded by Prince Charles, had kept so near the first as to appear to General Cope all one body. The Prince was only fifty paces behind the vanguard—a proof of courage which his enemies could not deny; but it was a departure from his agreement with the chiefs, who had made conditions that he should not expose himself to imminent danger.

General Cope's conduct was severely censured; but when inquired into by a board of general officers, he was not censured, and the conduct of the soldiery was made to bear the blame. 'His great error,' observes Sir Walter Scott, 'was in drawing up his forces in front of a high park wall, which barred their escape from their light-heeled enemies.' Collecting his dragoons, Cope, with the earls of Loudon and Home, marched to Berwick, where Lord Mark Ker received him with this sarcasm, 'that he believed he was the first general in Europe that had brought the first tidings of his own defeat.'

Great apprehension was now entertained in England lest the prince should immediately march southwards. But Charles and his council did not deem it prudent to appear in England with so small an army, and they resolved to wait some time longer at Edinburgh. The castle of Edinburgh remained still in the possession of the king's troops, commanded by General Guest. At first the garrison was supplied with necessaries from the town, but on the 29th of September orders were given to allow no person to pass into the castle. A letter was that evening sent down by General Guest to the provost of Edinburgh, declaring that unless a free communication was opened with the garrison and the town, the general would commence a cannonade upon the city. The prince, on hearing of this threat, ordered the communication to be re-opened. But the Highlanders having, on the 1st of October, fired at some people who were carrying provisions to the castle, the garrison on the next day began to fire on the houses that covered the prince's Highland guard. Upon this a contest

commenced between Prince Charles and General Guest, during which several houses were set on fire, and several persons on both sides killed. The cannonade lasted till the evening of the 5th of October, when Prince Charles at last published a proclamation permitting a communication between the town and the castle. Very few of the inhabitants of Edinburgh joined the Pretender during these destructive reprisals. There was, in fact, a disinclination among the common people to flock to his standard. Lord Kilmarnock and Arthur Elphinstone, afterwards Lord Balmerino, at this time joined the prince, and Lord Ogilvie, eldest son of Lord Airly, arrived in Edinburgh with a regiment of 600 men. These additions, and reinforcements sent by a few other noblemen and gentlemen, chiefly in the neighbourhood of the Highlands, together with supplies of arms and ammunition from France, strengthened the prince's cause.

It was now discussed by the prince's council in what manner their advantage could best be prosecuted. The prince, who was totally unacquainted with the country which he had invaded, could not bear opposition, nor listen to advice. Feuds and intrigues divided his little court; and too great confidence in his own opinion made him positive and resolute, when he ought to have been cautious. Having received all the reinforcements that he expected, he one day suddenly apprised his council that he was resolved to march to Newcastle, and to oppose the progress of Marshal Wade, who had advanced to that town. It was in vain that several of his friends opposed his determination. Three times it was brought before the council, and on the last discussion the prince settled the point by these words: 'I see, gentlemen, that you are determined to stay in Scotland, and defend your country; but I am also resolved to try my fate in England, even if I should go alone.'

On the 31st of October, Charles marched out of Edinburgh, leaving Lord Strathallan to command in Scotland. At Dalkeith House he was joined by the clan Macpherson and some other Highlanders, amounting in all to about 1000 men: this made his whole force about 6500. With one division of his army the prince marched to Kelso, then taking the Jedburgh road, he crossed the Esk, and on the 8th of November reached Brampton in Cumberland. On the next day the other division of the army arrived, and proceeded to invest Carlisle, which surrendered to the duke of Perth on the 15th of November. It was now determined to march directly to London. Before Charles had set foot on English ground, three armies, each of them superior in number to his own, were prepared to oppose his progress: one, under General Wade, at Newcastle; a second, in Lancashire, commanded first by General Ligonier, and afterwards by the duke of Cumberland; and a third, consisting of old regiments, was stationed in the villages near London, and was, in case of need, to have been commanded either by the king or the earl of Stair. The rebel troops nevertheless leaving a garrison in Carlisle, marched forward in two divisions; the first, commanded by Lord George Murray, arrived at Penrith on the 21st of November; the second, or main body, headed by Charles, chiefly composed of Highland regiments, and having the cannon, followed, and advanced from Penrith, by Shap, Kendal, Lancaster, and Garstang, to Preston. On the 29th they reached Manchester, by way of Wigan, and were joined by 200 or 300 of the common people. These men, the only Englishmen who joined the standard of the Pretender, were called the Manchester regiment, and were commanded by Colonel Townley, a Roman Catholic. Preston and Manchester were the only places where ringing of bells or acclamations were heard. From Manchester the rebel army marched to Macclesfield: from Macclesfield, the two divisions went by different roads; the one by Congleton, the other to Leek, and from Leek by Ashbourn to Derby, where on the 4th of December (1745) both divisions arrived. During the march from Carlisle to Derby, the prince learned that John Drummond, the duke of Perth's brother, had arrived at Montrose with his own regiment, the royal Scots, Fitzjames's regiment of horse, and the picquets of six Irish regiments in the service of France.

The duke of Cumberland's forces lay at Litchfield, Coventry, and Stafford. It seemed at first to be the intention of the rebels to avoid the duke, and to advance to London; but after halting a day or two in Derby, they altered their intention, chiefly upon the representation of George Murray, and retreated, with the design of meeting Lord Drummond's army, which was coming from the north. The retreat was resolved upon by the advice of Lord George Murray, and much to the dissatisfaction of Prince Charles. The duke of Cumberland now began the pursuit of the rebels, who were only two days' march before him. Lord George Murray, who commanded the rear-guard, defeated the duke's dragoons at Clifton near Penrith in a skirmish, in which the Highlanders fought with their usual courage, and Lord George, bareheaded (having lost his bonnet and wig), was foremost in the encounter. On the 20th of December the Scottish army left Carlisle, and crossed the Esk into Scotland. On this occasion the prince saved one of his men from being drowned by catching him by the hair. The Highland troops marched unmolested by Moffat and Dumfries to Glasgow, where they were by no means welcome. At Glasgow they remained seven or eight days, and the troops then began their march to Stirling, in two divisions. When the troops came near Stirling, the prince took up his abode in a house called Bannockburn. Lord George Murray's division occupied Falkirk. The town of Stirling soon surrendered, and Charles's army, now, by the junction of the forces of Lord Strathallan and Drummond, amounting to 9000 men, attacked the castle of Stirling. On the 16th of the month General Hawley left Edinburgh, which he had entered during Charles's absence, and marched to Falkirk; so that his army was now only seven miles distant from that of the Pretender. Lord George Murray marched at the head of the Macdonalds of Keppoch with his drawn sword in his hand. The Macdonalds began the fight, and repulsed the king's dragoons. 'When the Macdonalds came near the foot of the king's army,' says Home, 'some regiments of the first line gave them a fire; the rebels returned the fire, and throwing down their muskets, drew their swords, and attacked the regiments in the left of the king's army both in front and flank; all the regiments in the first line of the king's army gave way; as did most regiments of the second line. It seemed a total rout; and for some time General Hawley did not know that any one regiment of his army was standing.' General Hawley retreated to Linlithgow, leaving seven pieces of cannon and a quantity of provision, ammunition, &c. upon the field. A strong body of Highlanders, commanded by Lord George Murray, immediately took possession of Falkirk.

The friends of the House of Hanover were greatly dejected on hearing of the defeat; whilst the generals of the rebel party deemed it incomplete, and blamed each other. Charles remained at his quarters that night, and on the following day returned to Bannockburn. Meantime the siege of Stirling Castle proceeded slowly, owing to the superior fire of the castle. On the 30th of January the duke of Cumberland arrived at Edinburgh, whither General Hawley had retired; and on the following day the duke marched against the enemy. Lord George Murray with the clan regiments was now at Falkirk, and Prince Charles was still in the house of Bannockburn. The rebels at first resolved to make a stand, and to give the duke battle; but on the following morning they suddenly raised the siege of Stirling Castle, and retreated. Two explosions were the first signal of this event which reached the duke's ears; these were the powder-magazines blown up by the Highland troops, who retreated in disorder over the river Forth.

The Highlanders marched through Dumblane to Crieff, where the two divisions of their army separated: one, under Prince Charles, marched north by the highland road; the other, commanded by Lord George, proceeded through Montrose and Aberdeen, by the coast road, to Inverness. In the vicinity of that town both divisions approached each other. Charles, suffering his men to straggle about, lodged at Moy, the seat of Mackintosh, about ten miles from Inverness. Here he was saved from a surprise by the presence of mind of a woman. Lord Loudon, who was at Inverness, hearing that the prince had only five or six hundred men with him, set out one evening as soon as it was dark, with a design to seize him. Lady Mackintosh, the wife of Charles's host, is supposed to have been apprised of this attempt by letters from her mother. Without saying a word to Charles, she ordered five or six of the people, well armed, to watch on the road from Inverness, under the direction of a country smith. When Lord Loudon's troops drew near, the smith and his party gave them a shot or two, calling upon the Macdonalds and Camerons to join them. Lord Loudon's men, deceived by these shouts, retreated precipitately to Inverness, and many of

them were trampled down in the confusion of their flight. Charles, on the following day, hearing of this skirmish, which was called the Rout of Moy, marched to Inverness. Upon Lord London retreating, he laid siege first to Fort George, and next to Fort Augustus, both of which places he captured. During the months of February and March a desultory war was carried on, until, at the end of March, news was brought that the duke of Cumberland was marching towards Inverness with all his forces. On the 14th of April, Charles retreated from Inverness to Nairn, where he again made a stand. That night the Highlanders slept amid the furze and trees of Culloden wood, about three miles from Nairn. The prince's army was now much dispersed, and many of his best officers were absent. The Master of Lovat, son of Lord Lovat, was, as well as others, recruiting his forces. Lochiel however joined the army of Charles with his regiment; and, on the 15th, the army, reinforced by Keppoch and his regiment, was drawn out in order of battle upon Drummossie Muir, about a mile and a half to the southeast of Culloden House. About two o'clock the men were ordered to their quarters, and Charles, calling together the generals, announced his intention of making an attack upon the duke's army, then at Nairn. When he explained his design, the duke of Perth and John Drummond dissented; and Lochiel remarked, that on the next day the prince's army would be stronger by fifteen hundred men. But the matter was decided, when Lord George Murray seconded Charles's proposal, and urged the advantage of a night attack. Many men had gone to Inverness to get food; and the ranks were thinned: but Charles, bent upon a night attack, ordered the men to march at eight o'clock. At the appointed hour the Highland army advanced in a column, with an interval in the middle, according to a plan of Lord George Murray's, who marched in the front at the head of the Athol brigade. Charles and the duke of Perth were in the centre of the line of march. The night was very dark, and was far spent before the Highlanders reached Kilravock wood, where the officers, finding by their repeating-watches that it was two o'clock in the morning, consulted what was to be done; as Nairn was still more than three miles off, and it would be daylight before they could reach it. The matter was decided by Mr. Hepburn, who, on hearing a drum in the enemy's camp, observed, that if they should retreat they would be pursued; and that they would then be in a worse condition than they now were. The duke of Cumberland had gained intelligence of the attempt, and by five o'clock in the morning his army was on its march. The Highlanders, weary and dispirited, retraced their steps to Culloden, where many of them lay down to sleep. About eight o'clock the duke's forces were seen marching towards them; and about twelve, they were within two miles and a half of the rebels. About one o'clock a heavy cannonade was begun by the king's troops, and continued till two. The Highland regiments suffered severely, and a very inefficient fire was returned from their cannon. Colonel Belford, of the artillery, seeing a body of horse with Charles, who was stationed on a small eminence behind the right of the second line, pointed two pieces of cannon at them; one of Charles's servants, who stood behind him with a led horse, was killed, and the face of the prince was bespattered with dust. The Highlanders now became impatient to attack. A messenger was sent to Lochiel, representing the necessity for doing something. Whilst Lochiel was speaking to Lord George Murray, the Mackintosh regiment broke out from the line, and drove back the king's troops, sword in hand, but they were mostly brought to the ground by a terrible fire. A few desperate men pressed on, and perished by the bayonet. The Macdonalds and other Highland regiments now retired: it is said that the former were affronted by being deprived of the right, the post of honour, which their clan had possessed from time immemorial. It was in vain that the duke of Perth called upon them to behave themselves, and make a right of the left, declaring that if they did, 'he would henceforth call his name Macdonald.' The Highlanders were dispirited, and their condition became desperate.

At this crisis the duke of Cumberland advanced with the infantry, and the Highlanders fled; some retired to Badenoch, and others to the hills. Many who had fasted all day ran twenty miles without tasting food. The Fraser and Drummond's regiment retired to Inverness. The dragoons pursued and slaughtered the fugitives. When Charles saw, for the first time, his Highlanders repulsed and flying, he advanced to rally them; but Sir Thomas Sheridan dissuaded him from the fruitless attempt. The entreaty would not have availed, according to the testimony of the prince's standard-bearer, if General Sullivan had not led the prince's horse by the bridle from the field. Whilst some Highland troops still kept their ground, Lord Elcho, it is said, rode up to the prince, and exhorted him to make one final attempt to rally, or, at least, to die like one worthy of a crown. The reply was hesitating. Lord Elcho, with execrations, turned from him, for whom he had sacrificed everything, and swore never to see his face again; an oath which he kept.

The rebels are said to have lost about 1000 men; and among these were the bravest and the most devoted to the cause. The prince, after dismissing the troops which followed him, went to Gorthleck, where Lord Lovat was, and whence he sent a farewell message to the remnant of his army, thanking them for their services, but desiring them to attend to their own preservation. He next proceeded to Invergarie, near Fort Augustus, where he took leave of all his followers except Sullivan, O'Neil, and Burke, a servant who knew the country. Charles had now resolved to escape to France. For a time he kept about the islands of North and South Uist, sometimes in fishermen's huts, sometimes subsisting upon the bounty of the islanders; but generally in a state of the utmost privation. Hunted from place to place by the king's troops, his adventures are scarcely equalled by the fictions of any romance. General Campbell searched the island of Barra and South Uist in vain; and Long Island, in which he also took shelter, was surrounded by frigates and sloops of war. In this perilous condition Charles remained until the end of June, when he was delivered from his danger. Flora Macdonald, the daughter of Macdonald of Melton, in the isle of South Uist, was the generous and courageous woman who risked her life to save that of the prince. She had heard of his misfortunes and dangers, and expressed a wish to assist him. Charles was introduced to Flora, who undertook to convey him to Skye as her maid, dressed in female attire. As no one was allowed to go without a passport, she procured one for herself and her supposed maid Betty Burke. On the evening before they were to sail, she and Lady Clanronald met the prince at a place near Ormaclade, on the sea-shore. Whilst they were at supper here, news came that a party of officers and soldiers were searching Ormaclade in quest of Charles. Shortly afterwards, on seeing four armed cutters at a little distance, the ladies and the prince hid themselves among the rocks. About eight in the evening they sailed; and although threatened by a party of the Macleod's militia, who saw them from the shore, they pursued their way to Kilbride in Skye. Here Flora intended to lodge the prince at Mugstot, the seat of Sir Alexander Macdonald, but several of the king's soldiers being in the house, he was sheltered at the house of Macdonald of Kingsburgh, Sir Alexander's factor. On the following day Charles changed his attire, and crossed over to Rasay, where he lodged for some time in a cow-house; but growing impatient in this retreat, he returned to Skye, where he was assisted by the Mackinnons, and by their aid sailed to Loch Nevis, a lake in the mainland, where he was put ashore on the 5th of July. Here a number of the king's troops were stationed, and Charles was now enclosed between a line of posts formed by the officers who had notice of his situation. To escape this danger, he was forced, with a friend, to creep up the channel of a brook which was between two of these posts. He was accompanied by Macdonald of Glenaladale, with whom, after surmounting numerous difficulties, he reached the hill of Corado, between Kintail and Glenmoriston. Here he found some of his faithful followers living in a cave: wretched and altered as he was, his brave adherents knew him, and fell upon their knees. 'He had,' says Home, 'a coat of coarse dark-coloured cloth, and a wretched yellow wig, with a bonnet on his head. His brogues were tied with thongs, so worn that they would hardly keep on his feet. His shirt was saffron, and he had not another.' He remained in this cave five weeks and three days; and not even the reward of 30,000*l.* which was offered for his person, would have tempted these poor men, who sheltered the wretched descendant of the Stuarts. He continued his wanderings for many weeks; sometimes becoming so exhausted from fatigue and want of food, that he could not walk without help: at length, after many narrow escapes, he was able to cross Locharkaig,

and reach the fir-wood near Achnacarry. Here he heard from his faithful chieftains, Lochiel and Cluny, that they were at Badenoch, where he might with some risk join them. About the 29th of August Charles met his two friends, and was conducted by them to Letternilick, a remote place in the great mountain Benalder, where he remained until a vessel arrived at Lochnanuagh to convey him to France. On the 19th of September he reached Boradale, travelling only by night, and sailed for France on the 20th. he arrived at Morlaix in Brittany, on the 29th of September, 1746. During the wanderings of the prince, the secret of his concealment had been entrusted to hundreds of persons of every age and sex. Flora Macdonald was for some time confined in the Tower, but, being liberated, she found a home for a short time in the house of Lady Primrose, a Jacobite lady. No organised scheme for establishing Charles Edward upon the throne of England was ever afterwards formed.

Charles was received in France with professions of affection from Louis XV.; and, until his departure from France became necessary to ensure peace with England, he was well treated by the French king. In 1748, after the peace of Aix-la-Chapelle, the king of France could not allow him any longer to remain in his dominions. Charles long resisted the attempts made to induce him to leave France; and notwithstanding a letter from his father, recommending him to comply with the wishes of Louis, he remained at Paris. At length Charles, in stepping out of a coach from the Opera, was seized, and sent to Vincennes: and he was afterwards conducted with a guard out of the kingdom. After some delay he repaired to Rome. Charles Edward married a princess of the house of Stolberg in Germany, who survived him, and married Alfieri. [Alfieri.] The union was not happy, and the latter period of the prince's life was disgraced by habits of intoxication. He had no issue by his wife; but he left a natural daughter, whom he created duchess of Albany, and to whom he bequeathed a considerable property. For many years Charles seems to have cherished hopes of recovering the crown of Great Britain; but at length, when his claims ceased to be sustained by any foreign power, and when the courts of Europe no longer gave him the title of Prince of Wales, he took the title of Count of Albany, and sank into a habit of life strangely contrasted with his former activity. He died on the 31st of January, 1788. Notwithstanding his failings, Charles Edward possessed much energy and talent. His brother, Henry Benedict, who was created by the old Pretender duke of York, and afterwards made Cardinal York, was the last representative of the royal house of Stuart. Henry Benedict died at Rome in 1807.

STUART, ARABELLA, or ARBELLA, often styled, both by her contemporaries and by subsequent writers, the Lady Arabella, was the only child of Charles Stuart, duke of Lennox, younger brother of Henry, lord Darnley, the father of James I. James and she therefore were full cousins. Her mother was Elizabeth, daughter of Sir William Cavendish, father of the first earl of Devonshire. The birth of the Lady Arabella has been variously placed; in 1575 (by Oldys, in MSS. referred to by Kippis, 2nd edit. of *Biog. Brit.*), in 1575 or 1576 (Ellis's *Letters*, 2nd series, iii. 64), in 1577 (article 'Arabella,' in *Biog. Brit.*, written by Morant, who however states in a note in the same page that her father died in 1576, and 'left behind him' this his only child). Other accounts of the Lennox family assert that Arabella's mother died, before her husband, in 1574. (Fisher's *Companion and Key to the History of England*, p. 188.) The Lady Arabella also stood in the same degree of relationship to Elizabeth that James himself did through his mother; both were great grandchildren of Henry VIII.'s eldest sister Margaret; James through his mother, Queen Mary, and her father James V. of Scotland, son of that princess by her first husband; Arabella, by her father, Charles Stuart, and his mother, Margaret Douglas, the daughter of the English princess by her second husband, Archibald Douglas, earl of Angus. She was born in England; and during the reign of Elizabeth that circumstance was openly stated by Parsons, the Jesuit (in his *Conference about the next Succession to the Crown*, published under the name of Dolman, in 1594), as giving her claim to the throne an advantage over that of the Scottish king. At all events she was undoubtedly, before the birth of his son Henry, in February, 1594, the next in order of succession to James; and if he had died without issue, she would have been Elizabeth's heir, upon the same principle that he was so accounted.

The position in which she was thus placed by her illustrious descent, and near connection with the thrones both of England and Scotland, forms the key to the history of the Lady Arabella. While she was yet very young, it is said that her cousin, King James, wished to have her married to her relation, Lord Esme Stuart, whom he looked upon as his heir in case he should die childless, and whom he had created duke of Lennox; but this scheme, which must have been projected before 1583, the year in which Esme, duke of Lennox, died, was defeated by the opposition of Elizabeth. When she grew up, other matrimonial speculations were entertained with regard to her, some by herself, some by others; for a full account of which the reader is referred to the *Biog. Brit.*, and to Mr. D'Israeli's paper on 'The Loves of the Lady Arabella,' in his *Curiosities of Literature* (pp. 357-363, edit. of 1838). She first became an object of general public attention by the manner in which her name was brought forward in 1603, immediately after the accession of James, in the affair of the alleged plot called 'the Main,' for which Sir Walter Raleigh was tried: one of the charges against Raleigh was, that he designed to raise the Lady Arabella to the throne, under the protection of Spain. There is no probability however that any such design ever was entertained; it is at any rate admitted on all hands that the Lady Arabella knew nothing of it. (Howell's *State Trials*, ii. 1-60; Jardine's *Criminal Trials*, i. 389-520; Lingard's *Hist. of Eng.*, ix. 8-18; Tytler's *Life of Raleigh*, pp. 257-301.) But her situation was sufficiently difficult and dangerous one, without this unfounded suspicion or imputation; the more especially as she appears to have been entirely dependent even for subsistence upon the bounty of the crown. James's wish probably was, that she should remain unmarried; but in February, 1609, a discovery was made of a love affair in which she was engaged with a companion of her childhood, Mr. William Seymour, second son of Lord Beauchamp, the eldest son of the Earl of Hertford; and, although both parties were called before the council, and there sharply reprimanded and warned to take heed of what they were about, their affection disregarding all consequences, they managed to get secretly married very soon after. The marriage was discovered in the summer of the following year, 1610; on which Seymour was immediately committed to the Tower, and the lady placed under custody in the house of Sir Thomas Parry at Lambeth, from which it was some months after ordered that she should be transferred to Durham, there to remain under the charge of the bishop. This marriage probably excited James's alarm and fury the more, inasmuch as the Seymours inherited a claim to the crown which many persons thought better than his own, in virtue of their descent from Mary, the youngest sister of Henry VIII., upon whose representatives that king had settled the succession, in case of failure of his own issue, by a will which an act of parliament had certainly authorised him to make. [Henry VIII.] The Lady Arabella had scarcely set out on her forced journey to the north, in April, 1611, when she was taken ill, or professed to be taken ill, at Highgate; and here, in consequence, at the house of a Mr. Conyers, she obtained leave to remain, first for one and then for another month. When that term was about to expire, she set out, disguised in male apparel, and, attended by a Mr. Markham, about three o'clock in the afternoon of Monday the 3rd of June, took horse at a little inn about a mile and a half distant, and about six o'clock reached Blackwall, where, going into a boat that was in readiness, she was rowed down the river, and next morning was taken on board a French vessel that waited for her and her husband at Lee. Seymour meanwhile had also contrived to effect his escape from the Tower; but as he did not make his appearance so soon as had been agreed upon, the vessel set sail without him, and he was obliged to make a bargain with a coaster from Newcastle to take him across to Flanders, which he reached in safety. His wife was not so fortunate; a small ship of war was immediately despatched from the Downs to intercept her, and she was captured in Calais Roads. She and Seymour never again met. She was thrown into the Tower, where sickness and sorrow after some time deprived the poor victim of her senses, and she died insane in her prison, on the 27th of September, 1615. Many of her letters that have been preserved, and which have been printed by Mr. D'Israeli, Ballard (*Memoirs of*

British Ladies), and others, show that the Lady Arabella united no ordinary talent and literary accomplishment to her high spirit and passionate strength of character; and she also appears to have possessed a considerable share of personal beauty. Seymour was not only permitted to return to England the year after the death of his wife, but was the same year created a baronet; and, his father having died previously, he became earl of Hertfort on the decease of his grandfather, in 1621, and in 1640 was made marquess of Hertford, under which title he makes a considerable figure in the history of the civil war, in which he fought on the side of the crown, although he had allied himself to the parliamentary general the Earl of Essex by marrying his sister. He just lived to witness the Restoration, and to be restored by Charles II. to the dukedom of Somerset, which had been forfeited, as it had been acquired, by his great-grandfather the Protector; he died 24th October, 1660. It is worthy of being noted, that to one of his daughters by his second wife, he gave the name of her whom he had first loved and had not forgotten.

STUART, JAMES, frequently distinguished by the name of *Athenian* Stuart, was born in Creed-lane, Ludgate-street, in 1713, of parents in a very humble rank of life, and by the death of his father he was left, at a very early age, the eldest of a family reduced by that event almost to indigence. Beyond this no particulars are known relative to the intervening period before he could at all have contributed to the support of the family by his pencil. In the absence of evidence to the contrary, it may safely be assumed that his education must have been a very slender one; and that, in all probability, he had received very little instruction, if any, in drawing, when the talent he showed for it recommended him to Goupy, who kept a shop in the Strand, and who employed him to design and paint ladies' fans—a branch of art at that time greatly in vogue, and more encouraged than any higher kind of painting. Such was the school in which the future investigator of Athens and its monuments was trained. Fortunately Goupy himself was an artist of some ability, both as an engraver and painter in body colours, and being acquainted with the works of the best masters, his instructions were no doubt advantageous to Stuart. He continued with Goupy till about 1742, when he set out for Italy, for the purpose of improving himself. Little more is known of him during his residence in Italy, than that after staying at Rome nearly seven years, industriously occupied in painting, he embraced the offer made to him by his friend Revett, and Gavin Hamilton, of joining them in an excursion to Greece; though Hamilton, who was probably the originator of the scheme, afterwards declined accompanying them.

Revett (Nicholas, second son of John Revett, of Brandeston Hall, Suffolk) may be supposed to have been better qualified by education for an undertaking which required some knowledge of antiquity, whereas Stuart may be thought to have been very ill prepared. He had however, during his long residence at Rome, applied himself so diligently to the study both of the classical tongues and of archæology, at the College della Propaganda, as to be able to give proof of his proficiency in a Latin dissertation, 'De Obelisco Cæsaris Augusti Campo Martis nuperrimè effosso,' dedicated to Viscount Malton, and printed in 1750, at the pope's expense. Whether either himself or his companion had paid particular attention to architecture is doubtful, or rather, the probability is that they were acquainted with it merely as a collateral branch of art. At all events, it is not a little remarkable that it should have been reserved for two *painters* to show the world what Grecian architecture was, and thereby lead to a complete revolution in architectural taste. Having previously issued a prospectus of their undertaking, and raised funds for their tour, by subscriptions received from England, the travellers quitted Rome in March, 1750; and after passing some time at Venice, made an excursion to Pola in the following July, where they employed themselves three months in making drawings of the amphitheatre, &c., which however formed no part of their original work, and remained unpublished till 1816, when they first appeared in a fourth or supplementary volume, edited by Mr. Joseph Woods. In March, 1751, they reached Athens, where they remained till about the end of 1753; and while there, Stuart met with Mr. Dawkins, a lover of antient art, the companion and patron of Wood (author of 'Ruins of Palmyra'), and who afterwards proved a most liberal patron to Stuart also on his return to England, affording him both encouragement and assistance in preparing his materials for publication. Dawkins himself however did not live to see the 'Antiquities of Athens' in a published form, for he died about two years before the work was brought out.

Stuart and his companion returned to England in the beginning of 1755, but it was not until several years afterwards (1762) that the first volume of the 'Antiquities' was published. Stuart appears to have had by far the greater share in the labour, and the literary part is ascribed entirely to him. The work was well received by the learned, and by artists, notwithstanding that, owing to the delay in bringing it out, the subject had been forestalled by Leroi's 'Ruines,' &c. [LEROI.] The greater care bestowed upon the English work gave it however a permanent architectural value, while the rival one has fallen into disrepute as untrustworthy, and, though by a professional architect, as being more pictorial than antiquarian. Perhaps it was rather an advantage to Stuart, that in examining Grecian architecture he was unbiassed by any previous professional prejudices, and had nothing to unlearn. Still it was not every one who was satisfied with the first portion of the 'Antiquities;' for Winckelmann has spoken of it very disparagingly in a letter to Fuessly, where he hints that it had disappointed many persons both in England and elsewhere. Its success however admits of no dispute. There was considerable encouragement afforded just then to such studies, and it was about the same time that Adam published his work on Diocletian's Palace [ADAM], while Wood's 'Ruins of Palmyra' and 'Ruins of Baalbec' had appeared a few years previously, and the 'Ionian Antiquities' somewhat later.

The patronage and encouragement which Stuart received did not cause him to prosecute the continuation of his work very diligently, for the second volume was not entirely completed, and the third only in progress, at the time of his death. Neither was he very eager to avail himself to the extent he might have done of the opportunities afforded him as a practising architect. His patrons, the Marquis of Rockingham, Lord Anson, &c., had aided him so effectually, the latter bestowing on him the appointment of surveyor of Greenwich Hospital, that he was now in easy circumstances, and willingly relaxed from that continued exertion which prudence no longer imposed upon him as a duty. His employment as an architect was consequently by no means so extensive as it might have been, or equal to what his celebrity would have obtained for him. His principal work is the chapel of Greenwich Hospital, as rebuilt by him, after being destroyed by fire; but although beautiful as regards the details, and the individual decorations borrowed from Grecian architecture, it is not, if considered as a whole, very Grecian in character, if only because the numerous arched windows stamp it with a very different one. For Lord Anson he built a mansion in St. James's Square, and also several ornamental structures, in imitation of antique models, in the grounds of that nobleman's seat at Shuckburgh. He also erected Mrs. Montagu's house, Portman-square, and some other private mansions, but none of any particular note for their architecture.

Stuart was twice married. When he had reached the mature age of sixty-seven, he took for his second wife a very young woman, by whom he had five children; among them a son, who entered the navy, and died in 1800. Another boy, who is said to have exhibited an extraordinary talent for drawing, was carried off by the small-pox, not very long before his father's death, which occurred on the 2nd of February, 1788. The second volume of the 'Antiquities' was edited by Newton, in 1790; and the third, by Reveley, in 1794.

Between Stuart and his colleague Revett some differences appear to have taken place relative to the management of their joint publication, which were arranged by Stuart purchasing Revett's share in it, and such materials as he had provided towards the completion. Having got rid of that engagement, Revett undertook a second antiquarian expedition at the expense of the Dilettanti Society, for the purpose of exploring the remains of antient architecture in Ionia. The result of this tour, which occupied him about two years in company with Dr. Chandler, was the 'Ionian Antiquities,' the first volume of which was published in 1769. Like Stuart, he afterwards practised as an architect, was employed by Lord le Despencer at West Wycombe, and erected the church at Ayot, St. Lawrence, Herts, but was so far from realising an independence, that

le died in very straitened circumstances, in 1804, at the age of eighty-two.

STUART, GILBERT, LL.D., was the son of Mr. George Stuart, who was related to the learned grammarian Ruddiman, and filled the office of professor of Humanity, or Latin, in the University of Edinburgh, with much reputation, till his death in 1793. Gilbert was born at Edinburgh, according to the common account, in 1746; but in 1742, according to Kerr's *Memoirs of Smellie* (i., 499, and ii., 2). He was educated for the profession of the law; but a passion for general literature early took possession of him, and drew him off from his legal studies, so that he never was called to the bar. He first made himself known by his 'Historical Disquisition concerning the Antiquity of the British Constitution,' which he published in 1767, and which was held to have so much merit, that the University of Edinburgh immediately bestowed upon the youthful author the degree of LL.D. In the following year appeared his 'View of Society in Europe, in its Progress from Rudeness to Refinement; or, Inquiries concerning the History of Laws, Government, and Manners.' This work, which reached a second edition in 1778, displayed great reading, as well as ingenuity of speculation. Soon after it first appeared, the professorship of public law in the University of Edinburgh became vacant, and Stuart applied to the crown for the appointment, but unsuccessfully, in consequence, as he conceived, of the interference of the Principal, Dr. Robertson. This notion, and the event out of which it arose, had a great influence on the future course of Stuart's life and literary labours. If Robertson really did use his influence to prevent his appointment to the academical chair, it is believed that his reason was, the character for dissipation and intemperance which Stuart had already established for himself, notwithstanding his occasional hard reading and violent paroxysms of study. From this time he evinced, in addition to his unfortunate habits of life, a temper the most envious, malignant, and revengeful, which went far to destroy all the value of his undoubted learning and talents. On his failure in the matter of the professorship, he left Edinburgh for London, but without leaving behind him his personal resentments, which seem to have comprehended the general body of the literary men of his native city. In London, where he resided from 1768 to 1773, he is understood to have been chiefly employed in writing for the 'Monthly Review.' But he also found time to produce, in 1772, a satirical attack upon the newly published Latin Grammar of Dr. Adam, the rector of the High School of Edinburgh, under the title of 'Animadversions on Mr. Adam's Grammar, by Jo. Rich. Bushby;' and he is also understood to have been the writer of other papers in ridicule both of Adam's book and of himself, which appeared about the same time in the 'Weekly Magazine,' recently begun at Edinburgh by Walter Ruddiman, the nephew of the grammarian. Stuart (and his father, who is believed to have assisted him) had two special reasons for these aggressions: the new grammar was designed to supplant that of their relation Ruddiman, and Adam was besides a great ally of Principal Robertson. In 1772, also, Stuart edited (anonymously) the posthumous work of Francis Stoughton Sullivan, LL.D., entitled 'Lectures on the Feudal and English Laws.'

In 1773 he returned to Edinburgh; and then he and Mr. William Smellie, the printer (a man of talent and considerable literary acquirement), set up together a new monthly periodical, entitled 'The Edinburgh Magazine and Review.' The first number of this publication, which is not to be confounded with the original 'Edinburgh Review' established in 1754, in which Dr. Robertson, Adam Smith, &c. were writers, appeared in October, 1773, the 47th and last in August, 1776. The general spirit of the articles, especially of those written by Stuart, was of such unsparing severity, instigated too, as was conceived, in many cases by his personal resentments, that, notwithstanding the attraction of no common ability, a public feeling was at last aroused against the work, which compelled its conductors to give it up. A list of Stuart's reviews and other communications is given in Kerr's 'Life of Smellie,' i., 403-405. Of the former the most remarkable was an article on the first volume of Henry's 'History of Great Britain,' the first of a series of ferocious attacks on that work by Stuart, of which a full account may be found in Mr. D'Israeli's 'Calamities of Authors.' They were continued in the 'Political Herald' and the 'English Review,' two periodical works in which Stuart engaged when he returned to London some years after this, and the proprietor of which was his countryman Mr. John Murray, the father of the present eminent publisher of the same name. But meanwhile he produced several additional works in his own name while he still remained at Edinburgh; his 'Observations concerning the Public Law and Constitutional History of Scotland,' 8vo., Edinb., 1779 (an attack upon the introductory book of Dr. Robertson's 'History'); his 'History of the Establishment of the Reformation of Religion in Scotland,' 4to., London, 1780; and his 'History of Scotland from the Establishment of the Reformation to the Death of Queen Mary,' 2 vols. 8vo., London, 1782, another attack upon Robertson, founded on his alleged unfair treatment of the Scottish queen, whom Stuart zealously defends from all the charges brought against her. These works all drew considerable attention in their day, but they are now little read; the amount of learning and thought which they contain has not proved sufficient to buoy up the large portion of them composed of inconclusive unsatisfactory speculation, and the sophistry of mere passion and party spirit. They are all written however with much force and vivacity of style. Stuart returned once more to London in 1782; and he appears to have been principally employed in conducting the two publications belonging to Mr. Murray, already mentioned, for the next four years. But jaundice and dropsy, brought on and fed by persevering dissipation, had by the end of this space completely undermined his constitution. He returned to Scotland in the spring or summer of 1786, and died in his father's house at Musselburgh, on the 13th of August in that year.

(Kerr's *Memoirs of Smellie;* D'Israeli's *Calamities of Authors;* Chalmers's *Life of Ruddiman.*)

STUBBE, HENRY, was a remarkable example of temporary celebrity followed by nearly complete neglect and oblivion, the consequence of great natural talents and acquired knowledge not being matched with a sufficiency of judgment, and of there chancing to be little or nothing in a considerable mass of literary produce which has not been superseded by later works or by the progress of discovery. He was the son of a clergyman, and was born at Partney, near Spilsbye in Lincolnshire, 28th February, 1631. He spent his early boyhood in Ireland, whither his father had transferred himself and his family on being taken with a fancy for the doctrines of the Baptists; but after his death the breaking out of the rebellion in 1641 drove the widow and her son back to England, upon which young Stubbe was put to Westminster school, then presided over by Busby, with whom he became a great favourite. In 1649 he was elected a student of Christ Church, Oxford; where, although he made himself many enemies by his conceit and arrogance, he is said to have prosecuted his classical studies with such success, that while still an undergraduate he used to discourse in the public schools in very fluent Greek. He had before going to the University attracted the notice of Sir Harry Vane, from whom he received much substantial kindness; and this connection naturally attached him to the parliamentary cause—for which however he used to declare in after-life that he never had, had any real affection. But for a considerable time he exerted himself with much seeming zeal on that side in various ways. After he had taken his degree of B.A. he went to Scotland in 1653, and served for a couple of years in the army there; and then, having, on returning to Oxford, and taking his master's degree, been made under-librarian of the Bodleian, he got himself turned out after about two years, both from that office and from his studentship, by a succession of violent pamphlets which he published against the existing condition both of church and state, under the titles of 'A Vindication of Sir Harry Vane;' 'An Essay on the Good Old Cause;' and 'Light Shining out of Darkness, with an Apology for the Quakers.' Upon this catastrophe he betook himself to Stratford-on-Avon, and there practised as a physician till the Restoration, when he presented himself to receive confirmation from the hands of his diocesan, and in 1661 was sent out to Jamaica with the title of his majesty's physician for that island; but, finding the climate not to agree with him, he soon returned and re-established himself at Stratford, from which, after some time, he removed to Warwick, where he continued to reside till he met with his death, by being drowned in attempting to make his way across a river between Bath and Bristol, on the 12th of July, 1676. Stubbe, who seems to have had no principle, began to write against his old political friends and his former political

opinions as soon as the king returned; but his only writings after the Restoration that are now remembered are his attacks upon the Royal Society, the principal of which is his answer to Sprat and Glanville, entitled 'Legends no History, or a Specimen of some Animadversions upon the History of the Royal Society; together with the Plus Ultra of Mr. Glanville reduced to a Non Plus,' 4to., 1670. But here too he wasted his powers in a cause with which posterity has not sympathised. Anthony Wood, who was his contemporary at Oxford, has drawn his character graphically enough. He was, Wood says, 'the most noted Latinist and Grecian of his age; was a singular mathematician, and thoroughly read in all political matters, councils, ecclesiastical and profane histories: had a voluble tongue, and seldom hesitated either in public disputes or common discourse: had a voice big and magisterial, and a mind equal to it: was of an high generous nature, scorned money and riches, and the adorers of them; was accounted a very good physician, and excellent in the things belonging to that profession, as botany, anatomy, and chemistry.' Stubbe, with all his vast memory for words and facts, was plainly destitute of the faculty of distinguishing, in a case of any complexity, right from wrong, or truth from falsehood. Wood admits that he altogether wanted even common discretion. 'He was,' he says, 'a very bold man, uttered anything that came into his mind, not only among his companions, but in public coffee-houses, of which he was a great frequenter; and would often speak freely of persons then present, for which he used to be threatened with kicking and beating. He had a hot and restless head, his hair being carrot-coloured, and was ever ready to undergo any enterprise, which was the chief reason that macerated his body almost to a skeleton. He was also a person of no fixed principles; and whether he believed those things which every good Christian doth, 'tis not for me to resolve.' And in fine, Wood concludes by telling us that 'he became a ridicule, and undervalued by sober and knowing scholars, and others too.'

STUBBS, GEORGE, an eminent animal painter and anatomist, was born at Liverpool in 1724, and settled in London. He excelled especially in the portraits of horses. Fuseli observes, 'That his skill in comparative anatomy never suggested to him the propriety of style in forms, if it were not eminently proved by his Phaëton with the Horses of the Sun, would be evident from all his other figures, which, when human, are seldom more than the attendants on some animal; while the style of the animals themselves depended entirely on the individual before him: his tiger, for grandeur, has never been equalled: his lions are, to those of Rubens, what jackals are to lions; but none ever did greater justice to that artificial animal, the race-courser.'

Stubbs completed in 1766 his work 'On the Anatomy of the Horse,' in eighteen tables from nature; and before his death three numbers of another work (which was to have consisted of six), under the title of 'A Comparative Anatomical Exposition of the Structure of the Human Body with that of a Tiger and a common Fowl,' in thirty tables.

There are two pictures by this artist in the Grosvenor Gallery, the property of the Marquis of Westminster: one of them represents Portraits of Brood-Mares in a Landscape; the other, the Grosvenor Hunt. The scene is near Eaton Hall, in which portraits of the late Earl Grosvenor, of his brother, and others are introduced. These pictures have been considered the best works of this artist.

Dr. Waagen, speaking of the first of these two pictures, says, 'I was much pleased at meeting with a picture by this artist, of whose merits I had formed a high idea from engravings, and from his work on the Anatomy of the Horse. It represents horses under the shade of noble oaks: besides the great truth and the profound knowledge in the representation of the horse, it is treated with great ability; and the tone of the sky is very good.'

(Fuseli, *Dictionary of Painters*; Young's *Grosvenor Gallery*; Waagen's *Arts and Artists in England*.)

STUCCO, an Italian word adopted in most other languages, and applied as a general term to plaster of any kind used as a coating for walls, and to give them a finished surface. *Stuccatura*, or stucco-work, is the term similarly employed for all interior ornamental work in imitation of carved stone, so executed, such as the cornices and mouldings of rooms, and the enrichments of ceilings. Stucco was very much employed by the antients, and not merely for coating columns, &c. constructed of brick, but in many instances for covering stone or even marble; for which last purpose it was applied so sparingly as to be no more than a very thin incrustation, for the purpose, it is now supposed, of being painted upon. Recent inquiries into the subject of *Polychromy*, by Semper and others, have put it beyond doubt that the temple of Theseus at Athens, and other edifices of that period, were so painted. It is not improbable that stucco was used by the antients, in such cases, partly to protect the stone from decomposition, for they had the art of preparing it in the greatest perfection, and rendering their stuccoes and mortars almost indestructible.

The stucco used for internal decorative purposes, such as those above mentioned, is a composition of very fine sand, pulverised marble, and gypsum, mixed with water till it is of a proper consistency. Within a short time after being first applied, it begins to set, or gradually harden, in which state it is moulded, and may at length be finished up with metal tools. Even in buildings of the most sumptuous kind, whatever may be their other materials, though marble may be employed for the floors and columns of rooms, the cornices and ornaments of vaultings and ceilings are almost invariably of stucco-work, or else some other artificial composition, such as papier-maché, which is now beginning to be in request, and which has this advantage, that ornaments cast in it can be affixed with very little trouble to a ceiling or other surface originally left plain. Indeed, were it not for stucco or some substitute, it would be hardly possible to introduce any sort of carved work in such situations, such material as stone being out of the question for flat ceilings.

The stucco employed for external work is of a coarser kind, and variously prepared, being now manufactured wholesale as an article of commerce, ready for use, and of which the different sorts are generally distinguished by the name of *cements*. Adam's or Liardet's cement (so called from being that employed by the Adams [Adam], who first of all introduced stucco in this country as a substitute for stones, and from Liardet, who obtained a patent for it, in 1773) is an oil cement, of which the chief ingredients are fine whiting and calcined oyster-shells, well mixed and ground up in a mill with oil. This, if not the cheapest at first, is perhaps one of the best and most economical cements, as the test of about seventy years proves that it will bear this climate for a considerable length without exhibiting marks of decay. Parker's or Roman cement, that now most in vogue, consists chiefly of a preparation of argillaceous limestone found on the coasts of Essex and Kent, and in the Isle of Sheppey. Of Bailey's cement, lime and sharp sand are the principal ingredients; while mastic, or Hamelin's cement, is composed of peroxide of lead and oil. Keene's cement is one of very recent invention, and of very superior quality, taking a surface and polish almost equal to that of the finest marble. It is in fact a species of scagliola, consequently is employed, like that, only for interior decoration.

As an imitation of stone, much will depend upon the skill and care with which stuccoing is executed, on its being made to resemble stone as closely as possible, both as to tint and the grain or surface; and in order to render the deception as complete as possible, it is important, though it is not always done, that lines should be made on the face of the wall, indicating the joints and courses of stone work. If perfectly well executed, stucco will be nearly equal in appearance to stone, and even superior to that of stone of inferior quality. There are some who protest against the use of stucco externally, altogether, as a spurious and meretricious mode of building with sham material; but it is certain that most of Palladio's edifices, and of what are spoken of as the 'marble palaces' of Venice and Rome, are merely faced with stucco. If too the extensive application of stucco in this country, of late years, for architectural purposes, has given rise to a good deal of paltry and flimsy affectation of finery, it has been favourable to architectural design, and promoted a taste for it, by allowing it to be executed where stone would be too expensive a material, or where, if stone were employed, the same extent and degree of enrichment could not be afforded.

STUHLWEISSENBURG, a county in the kingdom of Hungary, is bounded on the north by Comorn, on the east by Pesth, on the south by Tolna, and on the west by Vesprim. The southern and larger portion of the county is flat, with some inconsiderable hills; the northern part is mountainous, being traversed by some branches of the Bakony and Vertes chains. The whole of the right bank of the Danube is high. The principal rivers are, the Danube,

which separates it from Pesth, and the Sarwitz. There are many other smaller streams. The Sarwitz, which has a very slow current, makes many stagnant pools and marshes, which cover many thousand acres of land: an expensive canal has however been formed, by which part of the marshes has been drained and rendered fit for agriculture. The area of the county is 1600 square miles, of which 799,853 acres are stated to be useful land, viz. 360,411 acres arable land, 81,060 pasturage, 23,814 vineyards, 8917 garden-land, and 316,651 forests. The soil is extremely fertile: it produces corn, especially wheat of remarkably fine quality; pulse, garden vegetables, and abundance of fruit. Tobacco, woad, and madder are likewise cultivated. Red and white wines are made in considerable quantity, but they are not much esteemed, because they will not keep. The breed of horses, oxen, and swine is good; but the country is chiefly remarkable for numerous flocks of fine sheep. The rams are highly valued, and numbers of them are purchased for other counties. Beasts of prey, especially wolves, and all kinds of game, are found in abundance in the forests. Fish of various kinds are taken in the rivers and lakes. In the Sarwitz and the marshes there are many crabs, tortoises, wild ducks and geese, and other water-fowl. The population is said not to exceed 130,000, who are descended partly from Slavonians, and partly from Magyar and German settlers. The majority are Roman Catholics; but the Protestants, and especially Calvinists, are numerous.

STUHLWEISSENBURG, the capital of the county, is situated in 47° 12′ N. lat. and 18° 25′ E. long., in a marshy spot near the Sarwitz, and is surrounded with numerous canals for draining the marshes. It has two suburbs, which are surrounded with a deep moat, and connected with the town by bridges. This town has greatly declined from its ancient splendour; and though there are several fine buildings, it has on the whole a mean appearance. It was founded in the eleventh century by King Stephen, was for five hundred years the place where the kings of Hungary were crowned, and where many of them were buried, from Stephen I, who died in 1038, to Zapolya, who died in 1540. From this circumstance it was called Alba Regia or Regalis. It is said to be built on the site of the Roman Floriana. When the contest for the possession of Hungary by the house of Austria began, under the emperor Frederick III., Maximilian I., king of the Romans, took the town in 1490 but was not able to retain it against Bathori. In 1543 it capitulated to the Turks under Soliman the Magnificent. The Turks were defeated in 1593, in the vicinity of the town, by Palfy, Nadasli, and Zrinyi, the generals of the emperor Rudolph II.: but still kept possession of it. In 1601 the duke of Mercoeur and General Russworm took it by storm: Hassan Pasha, who attempted to retake it, was defeated in a great battle; but the garrison having mutinied, it again fell into the hands of the Turks in 1602. When the Turks were at length expelled from Hungary by the armies of Leopold I., the town was taken in 1688 by the elector of Bavaria. The empress Maria Theresa made this town a bishop's see in 1772. The principal public buildings are, the court-house, remarkable for its great extent and fine architecture; the episcopal palace; the palace of Count Schmidegg, in which are the post-office, the coffee-house, and assembly-rooms; and of the six churches, the cathedral, and the church of St. Mary, built by Stephen I. with the spoils taken in war. There are also a gymnasium, a seminary, a normal school, a military academy, and a Hungarian theatre. There are some manufactures of coarse cloth and flannel, but the inhabitants depend for subsistence chiefly on gardening and agriculture. The environs are extremely fertile.

(Hassel; Jenny, *Handbuch für Reisende*; Thiele, *Das Königreich Ungarn*; *Statistisch-Geographische Beschreibung der Königreiche Ungarn, Croatien, Slavonien, &c.*)

STUKELEY, THE REV. WILLIAM, M.D., was descended from an antient Lincolnshire family, and was born at Holbeach in that county, on the 7th of November, 1687. From the grammar-school of his native town he went to Bennet College, Cambridge, in 1703. At this time natural science, as connected with the profession for which he was intended, seems to have been his favourite pursuit; and the chief assistant of his studies was Stephen Hales, afterwards celebrated for his physical investigations and discoveries, who was a member of the same college. Hales and he, we are told, were wont to ramble over Gogmagog Hills and the bogs of Cherry Hunt Moor, gathering simples; Stukeley, who was a ready draughtsman, having added a map of the country to a copy of Ray's Latin Catalogue of the Plants growing around Cambridge, which they used to take with them as their guide. The two friends also applied themselves together to anatomy and chemistry, and performed many curious dissections and experiments. (*Account of Hales*, drawn up from materials furnished by Peter Collinson, F.R.S., in *Annual Register* for 1765.)

Having taken his degree of M.B. in 1709, Stukeley afterwards repaired to London, where he attended St. Thomas's Hospital as a pupil of Dr. Mead; and then he settled as a medical practitioner at Boston, in his native county. In 1717 he removed to London; in 1719 he took his degree of M.D.; in 1720 he was admitted a Fellow of the College of Physicians; but although he appears to have continued to rise in his profession, he left the metropolis in 1726, and, returning once more to Lincolnshire, fixed himself at Grantham. Here he soon acquired great reputation. His health however had been for some years giving way, and in 1729, on the persuasion, it is said, of archbishop Wake, he relinquished medicine and took orders. The same year he was presented by lord chancellor King to the living of All Saints in Stamford; and some time after, having become chaplain to the duke of Ancaster, he received from his grace, in 1739, the living of Somerby, near Grantham, which he seems to have held along with his Stamford preferment. But in 1747 he was presented to the rectory of St. George the Martyr, in Queen Square, London, by the duke of Montague, with whom he had become acquainted some years before, when they were brought together as founders of the Egyptian Society; and this brought him once more up to the metropolis, which, or Kentish Town, in the immediate neighbourhood, continued to be his residence for the rest of his life. He died in the rectory-house, on the 3rd of March, 1765, from a stroke of palsy with which he had been attacked a few days before.

The taste for antiquarian research showed itself in Stukeley at an early age, and occupied much of his leisure even when his chief attention was given to other studies. It is only as a writer on British antiquities that he is now remembered. His only medical publication is a tract entitled 'A Dissertation on the Spleen,' which appeared in 1723, and is said to have been well received. But even before this he had published his first antiquarian work, 'An Account of a Roman Temple (the celebrated Arthur's Oven) and other Antiquities near Graham's Dike in Scotland,' 4to., London, 1720. This was followed by his 'Itinerarium Curiosum, or an Account of the Antiquities and Remarkable Curiosities in Nature or Art observed in Travels through Great Britain;' illustrated with copper-plates, fol., 1724. A second volume, or 'Centuria,' as it is designated, was added to this work from the papers and drawings he left at his death ready for the press; and was given to the world, along with a reprint of the former volume, in 1776. It is of all Stukeley's works the one that is now most sought after. His next publications were his two works on the great druidical or supposed druidical remains in the west of England:—the first, entitled 'Stonehenge and Abury, two Temples restored to the British Druids,' fol., 1740; the second, 'Abury, a Temple of the British Druids,' fol., 1743. [AVEBURY.] A new edition of these two works was published at London, in two vols. folio, in 1838. In 1743 also appeared his 'Palæographia Britannica,' 4to. He produced nothing more except some communications to the 'Archæologia' and the 'Philosophical Transactions,' till, in 1757, he printed, in a separate tract, his account, with extracts, of the work of Richard of Cirencester, 'De Situ Britanniæ,' sent to him as having been recently discovered at Copenhagen, by J. C. Bertram [RICHARD OF CIRENCESTER]; but a more extended account of this work is given in the second or posthumous Centuria of his 'Itinerarium Curiosum,' already noticed. In 1757 appeared, in a quarto volume, one of his most remarkable works, entitled 'Some Account of the Medallic History of Marcus Aurelius Valerius Carausius, Emperor of Britain.' 'I have used his materials,' says Gibbon, in one of his notes, referring to this work, 'and rejected most of his fanciful conjectures.' No antiquarian ever had so lively, not to say licentious a fancy as Stukeley; the idea of the obscure remote past inflamed him like a passion; most even of his descriptions are rather visions than sober relations of what would be perceived by an ordinary eye; and never before or since were such broad continuous webs of specula-

tion woven out of little more than moonshine. He possessed however a great deal of real ingenuity as well as learning; and all his works contain many things that are both curious and valuable, some of them much that would by this time have been irrecoverably lost but for his record of it, although few if any of either his theories or his histories are to be received throughout with implicit faith. His only theological work, we believe, was a collection of Sermons, published in 1760, under the title of 'Palæographia Sacra,' principally occupied with the natural history and botany of the antient world. As a man, Stukeley appears to have been distinguished by a very placid and amiable disposition.

(Hutchinson's *Medical Biography; Notice*, by Collinson, in *Annual Register* for 1765.)

STURGEON. [STURIONIDÆ.]

STURIO'NIDÆ, a family of fishes belonging to the section *Chondropterygii*, the species of which are distinguished from others of the section by the gills being free, as in ordinary fishes, thus differing from the second great division of the fishes having a cartilaginous skeleton, such as the Sharks and Rays, in which the gills are fixed, and have their outer margin attached to the skin. The *Sturionidæ*, or Sturgeon tribe, have moreover but one opening to the gills, and this is protected by an operculum.

Four genera are contained in this family, *Accipenser, Spatularia, Chimæra*, and *Callorhynchus*. To the first of these genera belongs the common sturgeon (*Accipenser Sturio*, Linn.), which is not unfrequently met with in mouths of the English rivers. It is of an elongated form, and has the body protected by numerous indurated plates, which are arranged in longitudinal series, the head is entirely covered by bony plates; the muzzle is elongated, and more or less pointed; and the mouth, which is placed on the under side of the head, is tubular, and destitute of teeth: on the back is a single dorsal fin, which is placed on the hinder third of the fish; the tail is forked, and the upper lobe is the largest, as in the Sharks.

'In the northern part of Europe,' observes Mr. Yarrell, 'this fish is much more numerous than with us, and extensive fisheries are established for its destruction. Caviar is made of the roe of the female; isinglass is obtained from the dense membrane forming the air-bladder; and the flesh besides being preserved by salting and pickling, is in request for the table while fresh, being generally stewed with rich gravy, and the flavour considered to be like that of veal. The flesh, like that of most of the cartilaginous fishes, is more firm and compact than is usual among those of the osseous families.'

Two species of sturgeon have long been distinguished by the fishermen of the Solway Firth, the one with a blunt nose, and the other with a sharp nose: the latter is the most common of the two; the former has recently been described by Dr. Parnell, in the 'Transactions' of the Royal Society of Edinburgh (vol. xiv., pl. 4), and is introduced by Mr. Yarrell, in the Supplement to his 'History of British Fishes.'

Several very distinct species frequent the rivers of Russia, and will be found described and figured by M. A. Loretzky, in the third volume of the 'Transactions' of the Imperial Society of Naturalists at Moscow. Three species are found in the rivers which flow into the Black Sea, and moreover North America possesses species which are peculiar.

The genus *Spatularia* is distinguished by the enormous prolongation of the muzzle, the sides of which are dilated. The general form of the body nearly resembles that of the Sturgeons; but the gills are more open, and the operculum is prolonged into a membranous point behind; the mouth is deeply cleft, and well provided with small teeth; the lobes of the tail are very nearly equal. But one species of this curious genus is known (*Squalus Spatula*, Mauduit), and that is an inhabitant of the Mississippi.

Genus *Chimæra*, Linn.—Although placed in the present section, the *Chimæræ* differ considerably from the sturgeons, and are in fact very nearly allied to the sharks. 'Though in these fishes there is but one apparent gill-opening,' observes Dr. Richardson, in his 'Fauna Boreali-Americana,' 'the gills in reality adhere by a large part of their borders, and there are consequently five holes communicating with the external gill-opening.' They have a rudimentary operculum concealed by the skin; and their jaws, still more reduced than those of the sharks, are furnished with hard plates, four above and two below, in place of teeth. The males are distinguished by trifid bony appendages to the ventral fins. The eggs are large and of a coriaceous texture, and have flattened and hairy margins. The snout, supported like that of the sharks, projects forwards, and is pierced with pores arranged in tolerably regular lines; the anterior dorsal fin is armed with a strong bony spine, and is placed over the pectorals.

In the genus *Chimæra*, as at present restricted, the snout is conical; the second dorsal fin commences immediately behind the first, and extends to the tip of the tail, which is elongated and pointed, and terminates in a long filament: on the under side, the tail is also furnished with a long but narrow fin. Only one species is known, the Northern Chimæra (*Chimæra monstrosa*, Linn.). This fish inhabits the European Seas, and is said to be frequently caught following the shoals of herrings, on which it preys. It is usually about two or three feet in length, and the general colouring of the body is silvery-white, but the upper parts are mottled with brown.

The next genus differs from *Chimæra* chiefly in having the snout terminated by a largish fleshy appendage. The second dorsal fin is placed over the ventrals, and terminates opposite the commencement of the lower tail-fin. The only species known, until very recently, was the Antarctic Chimæra (*Chimæra Callorhynchus* of Linnæus), an inhabitant of the South Seas. A second species of *Callorhynchus* is described by Mr. Bennett under the name *Cal. Smythi*, in the zoological appendix to Beechy's 'Voyage;' and more recently Dr. Richardson describes a species of the present genus (*C. Tasmanius*),* which he regards as distinct. It is from Port Arthur, Van Diemen's Land.

STURM, JOHN, was born on the 1st of October, 1507, at Schleiden in the Eifel, between Treves and Cologne. In 1524 he went to Louvain, where he devoted himself to antient literature, but after a few years' study he entered into partnership with Rutger Rescius, an eminent Greek scholar, who was forming a printing establishment at Louvain for the printing of Greek authors. The only works that are known to have issued from their press are an edition of Homer, and one of Xenophon's 'Memorabilia Socratis,' which appeared in 1529, 4to. In this year Sturm went to Paris, probably with the intention of forming connections for the sale of his publications. But the very favourable reception which he met with at Paris, and the new world which here opened upon him, determined him not to return to Louvain. He began to occupy himself with teaching, and soon obtained permission to set up a school. Sturm had adopted the Lutheran creed before he left Germany, but took care not to avow it in public. At Paris however it appears to have become known to some persons, and the severe regulations in France against Protestantism at last induced him to go to Strassburg, in which city a gymnasium was just established. The office of rector of the school was offered to Sturm, who entered upon it in 1538. Owing to his exertions and the generous support of the city of Strassburg, this gymnasium soon became one of the most flourishing in all Germany, until, in the year 1566, it was raised to the rank of a university, under the management of Sturm. While he was devoting himself with the utmost zeal to his duties as a teacher and rector, he was no less active in promoting the interests of Protestantism. He was sent on various missions concerning religious matters, and was extremely liberal and kind towards all who suffered for their religious opinions. But he showed nothing of a sectarian spirit, and some of his friends, who were staunch Lutherans, began to suspect him of leaning towards the doctrines of Calvin. They openly attacked him in their sermons, the consequence of which was that he gave up attending them. His silence and perseverance excited their anger and hatred. Various charges were at last brought against him, among which it was alleged that he had not been at church or partaken of the Lord's Supper for twenty years. His enemies at length succeeded, in 1583, in persuading the magistrate of Strassburg, on the pretext of his old age, to deprive him of his office, which was given to Melchior Junius, one of his former pupils. Notwithstanding the honourable appearance of his dismissal, and although he was left in the enjoyment of his former salary, he keenly felt the wrong which was done to him. His strength rapidly declined, and a few years before his death, which took place on the 3rd of March, 1589, he lost his sight.

Sturm was one of the most amiable, benevolent, and

* 'Proceedings of the Zoological Society,' for March, 1840, p. 29.

learned men of the age. He went so far in his liberal support of persecuted Protestants, that he became involved in great pecuniary difficulties; but he was far from being a vehement sectarian. He appreciated the merits of every man, whatever might be his religious opinions, and he was no less esteemed by Roman Catholic prelates, than by the moderate party among the Protestants. As a teacher he was eminently successful. On account of his great knowledge of rhetoric, and his elegant Latin style, he was called the German Cicero. His works, all of which are written in Latin, are very numerous. The following are the most important:—'De Literarum Ludis recte aperiendis,' Strassburg, 1538, 4to.; 'In Partitiones Ciceronis Oratorias Dialogi Quatuor,' Strassburg, 1539, 8vo.; 'M. Tullii Ciceronis Opera Omnia, editio post Naugerianam et Victorianam emendata à Jo. Sturmio,' Strassburg, 1540, 9 vols. 8vo., often reprinted with corrections and emendations; 'Prolegomena, hoc est, Praefationes in optimos quosque utriusque Linguae Scriptores,' Zürich, 1565, 8vo.; 'De Universa Ratione Elocutionis Rhetoricae Libri Quatuor,' Strassburg, 1576, 8vo. (this work, which in reality only consists of three books, is a very elaborate and systematic commentary on the rhetorician Hermogenes); 'Anti-Pappi Quatuor,' Neustadt, 1580, &c., 4to. (this work contains his theological controversies with Pappus, Osiander, and others). His treatises on education have been reprinted in several collections of works on this subject.

(Jöcher, *Allgem. Gelehrt. Lex.*, iv., p. 910, &c.; Saxius, *Onom.*, iii., p. 152; *Biographie Universelle.*)

STURM, JOHN CHRISTOPHER, a German mathematician and natural philosopher, was born at Hippelstein, in Bavaria, November 3, 1635. His father, who was master of the wardrobe to the elector of Bavaria, having been ruined by the wars, the youth was indebted for the benefits of a good education to the benevolence of Daniel Wulfer, a clergyman of Nürnberg, who placed him at a school in that city, where, during eight years, he was engaged in the study of the antient languages and such of the sciences as were then taught. Having made considerable progress, young Sturm was sent by his benefactor to the university of Jena, where he took his degrees; and in 1660 he went to study at Leyden. He remained there only one year, and then he returned to Jena, where he qualified himself for the church. He was appointed to the ministry for one of the parishes in the territory of Ettingen, where he continued to perform the duty till 1669, when, through the interest of his friends, he was appointed professor of mathematics in the university of Altdorf, in Franconia. This post he held during thirty-four years, and it is said that he was the first who introduced, in the gymnasia and the common schools of Germany, the practice of giving instructions in the elements of useful science to the children of the working classes.

Sturm had been educated in the philosophy of Aristotle, but in his visit to Holland he became acquainted with that of Descartes; and, after a vain effort to reconcile the principles of the antient with those of the modern physics, he formed for himself a species of philosophy by selecting whatever, in either, appeared most consonant to nature and reason. This philosophy he endeavoured to introduce into the schools of his country; and though he did not wholly succeed, he contributed much to the general diffusion of a knowledge of the physical sciences in the north of Europe.

He died December 26, 1703, leaving a son, Leonard Christopher Sturm, who became an architect.

The principal works of Sturm are, 'Collegium Experimentale sive Curiosum, in quo primaria hujus seculi Inventa et Experimenta Physico-mathematica An. 1672,' Nürnberg, 1676, 2 vols. 4to.; 'Cometarum Natura, Motus, et Origo, secundum Hevelii et Petiti Hypotheses,' Altdorf, 1677, 4to; 'Mathesis Enucleata,' 1 vol. 8vo.; 'Mathesis Juvenilis,' 2 vols. 8vo., of which the second contains a tract entitled 'Scientia Cosmica, sive Astronomica, Spherica, et Theorica Tabulis comprehensa,' Nürnberg, 1684: 'Physicæ Conciliatricis Conamina,' Nürnberg, 1685; 'Philosophia Eclectica,' Nürnberg, 1685, being a collection of the principal dissertations before published on the different systems of philosophy. Sturm also published a translation in Latin of the 'Hydraulic Architecture' of Bockler; a German translation of Archimedes; and a collection of letters to Dr. Henry More of Cambridge, on the weight and elasticity of the air. In 1684 he published a second part of the collection of discoveries made up to that time; and editions of both parts, together with the letters to Dr. More, were published in 1701 and 1715; these contain many curious experiments.

STURM, CHRISTOPH CHRISTIAN, was born on the 25th of January, 1750, at Augsburg. He studied theology at Jena and Halle, and was subsequently appointed preacher at Magdeburg. In 1778 he obtained the offices of pastor at the church of St. Peter, and of Scholarchus, at Hamburg. His sincere piety, his zeal as a religious instructor of the people, and his learning gained for him the love and esteem of his flock. His leading principle was that a preacher should render his knowledge of true religion and morality fruitful in his own actions before attempting to effect the same in others by his instruction: and his whole life, which is marked by scarcely any incidents, was only characterised by the honest endeavour to carry his principle into practice. He died on the 26th of August, 1786.

Sturm wrote many religious works, which are more of a practical than of a scientific character. The following are the most important:—'Der Christ in der Einsamkeit,' Halle, 1763; 'Der Christ am Sonntage,' 1764, &c.; 'Unterhaltungen mit Gott in den Morgenstunden auf jeden Tag des Jahres,' 1768, 2 vols. 8vo., and often reprinted; 'Betrachtungen über die Werke Gottes im Reiche der Natur und der Vorsehung auf alle Tage des Jahres,' 1785. This work has been translated into most of the European languages, and also into English by Clarke, under the title of 'Reflections on the Works of God,' &c. The numerous editions of this translation show that the work has been very popular in England. Sturm also published a considerable number of sermons, and among them a collection of sermons for children: 'Predigten für Kinder von reiferem Alter,' Leipzig, 1774, 2 vols. 8vo. Sturm also occupies a considerable rank among the writers of sacred poetry, which he published in four collections: 'Gebete und Lieder für Kinder,' 1776; 'Gesangbuch für das reifere Alter,' 1777; 'Lieder für das Herz,' 1787; and 'Gesangbuch für Gartenfreunde,' all of which breathe the purest piety. Many of his sacred songs have been incorporated into the hymn-books which are used in the Protestant churches of Germany.

STURM'S THEOREM. There is a branch of the theory of equations, containing the celebrated theorems of Descartes, Fourier, and Sturm, which it is advisable to place in an article by itself, and the present heading has been chosen because Sturm's theorem is at once the most conclusive and the latest of the three. It has long been a problem of much interest and notoriety to find, in a given equation, how many roots, if any, are contained between two given limits: how many roots are positive, how many negative, how many imaginary.

The first step towards the solution of the preceding problem was made by Descartes, though it is asserted by Cossali and Libri, that Cardan came very near to the same step. The former, after collecting a table of Cardan's cases, and putting them in a form which Cardan did not use (an equation with 0 on the second side), then says that an analyst who should look at this table would be able to rise to Descartes's theorem. This is true enough, but it does not prove that Cardan either could or did make the invention, but the contrary. All the world knows that mathematical discoveries are recognised often enough by analysts of a later day, in rudiments from which the fabricators of them could evolve nothing.

The theorem of Descartes, expressed in his own words, is as follows (*Geometria*, lib. iii.): 'Ex quibus etiam cognoscitur, quot veræ et quot falsæ radices in unaquaque Æquatione haberi possint. Nimirum, tot in ea veras haberi posse, quot variationes reperiuntur signorum + et −; et tot falsas quot vicibus ibidem deprehenduntur duo signa +, vel duo signa −, quæ se invicem sequuntur.' That is, that an equation may have as many positive roots as there are changes of sign in passing from term to term, and as many negative roots as there are continuations of sign; but not more of either kind. It has been doubted whether Descartes knew the true meaning of his own theorem as to the case of imaginary roots; this doubt is as early as the time of Descartes himself, who replies in a letter which we cannot find by means of Rabuel's reference to it. This is however of little consequence, as the following sentence (also from the Geometry) shows in what manner Descartes understood his own words: 'Cæterum radices tam veræ quam falsæ non semper sunt reales, sed aliquando

[illegible] integer [illegible]; [illegible] semper quidem in qualibet Equatione [illegible] imaginariæ licet: verum nulla interdum est quantitas quæ illis, quas imaginamur, respondet' [illegible] then that Descartes not only remembered the limitation of the theorem arising from the possible existence of imaginary roots, but proposed to divide those last [illegible] themselves into two classes corresponding to the [illegible] false (or positive and negative) of the real roots. The next step was made by De Gua (1741), who showed that the roots of an algebraical equation $\phi x=0$ [illegible] real [illegible] the roots of the derived equations $\phi' x=0$, $\phi'' x=0$, &c. are also all real: $\phi' x$, $\phi'' x$, &c. being the derived functions, or differential coefficients, of ϕx. [illegible] the conditions of the reality of all [illegible] (Lagrange, *Rés. des Équ. Numér.*, note [illegible] &c. [illegible] 27.)

[illegible] would be perfect if the roots of equations were always real. For example, take $x^2-13x+40=0$. [illegible] both positive: write $x+6$ for x [illegible], and we have $x^2-x-2=0$, of which the roots are less by 6 than those of the former [illegible] in the second equation, one root is negative [illegible] positive: consequently the roots of the first equation [illegible] greater and one less than 6. In the same [illegible] more complicated case might be treated.

The theorem of Descartes, and the notion derived from [illegible] order of signs of coefficients regulates the signs [illegible] roots; with the step made by De Gua, and the notion [illegible], namely, that the derived functions must be [illegible] whether the roots of an equation [illegible] and the common theory of equal roots, [illegible] when $\phi x=0$ has m equal roots, $m-1$ of its [illegible] (neither more nor fewer) vanish at the [illegible] the same root,—were the hints on which Fourier was able to make an advance upon his [illegible]. The coefficients of the equation are themselves [illegible] the derived functions, on the [illegible]. Thus, if $\phi x=3x^3-7x^2+11x+4$, we have

$$\phi 0=4,\quad \frac{\phi' 0}{1}=11,\quad \frac{\phi'' 0}{1.2}=-7,\quad \frac{\phi''' 0}{1.2.3}=3.$$

Let ϕx, $\phi_1 x$, $\phi_2 x$, &c. be the function in question and its [illegible] functions. If we make x great enough and negative (say infinite and negative), the signs of these functions [illegible] alternate, that is, the series yields nothing but changes of sign in passing from term to term. But if we make x great enough and positive (say infinite and positive), the series yields nothing but permanences of sign. Thus, in the preceding expression we have

	$x=-\infty$	$x=0$	$x=+\infty$
ϕx	$-$	$+$	$+$
$\phi_1 x$	$+$	$+$	$+$
$\phi_2 x$	$-$	$-$	$+$
$\phi_3 x$	$+$	$+$	$+$
	nothing but changes.	two changes.	no changes.

$$\phi x=3x^3-7x^2+11x+4,\quad \phi_1 x=9x^2-14x+11,$$
$$\phi_2 x=9x-7,\quad \phi_3 x=3.$$

Now Descartes's theorem tells us that there *may* be *one* negative and *two* positive roots, and we see that in passing from $x=-\infty$ to $x=0$, or through the whole range of negative quantity, there is *one* change of signs lost; while in passing from $x=0$ to $x=+\infty$, or through the whole range of positive quantity, *two* changes of sign are lost. Fourier's theorem would suggest itself as highly probable to any one who put Descartes's theorem in the preceding form: it is as follows:—When $x=a$, let the signs of ϕa, $\phi_1 a$, $\phi_2 a$, &c. be [illegible], and let this be called the criterion series, or simply the criterion. Then in passing from $x=a$, the less, to $x=b$, the greater (greater and less being understood in the algebraical sense), the criterion never acquires changes of sign, though it may lose them. When m changes of sign are lost in the criterion in passing from $x=a$, the less, to $x=b$, the greater, it follows that there are either m real roots of the equation lying between a and b, or some number, p, of pairs of imaginary roots, and $m-2p$ real roots lying between a and b. If m be odd, there must be at least one real root lying between a and b. And if no changes of sign be lost in passing from a to b, there is certainly no root lying between a and b. For example, examine the preceding function and its derivatives when $x=-1$ and $x=+1$. In the former case the criterion is $-+-+$ (three changes), and in the latter $++++$ (no changes). Three changes then are lost to the criterion in passing from -1 to $+1$: so that there are either three real roots, all lying between -1 and $+1$: or one such real root and two imaginary roots. Again, in passing from -1 to 0, one change is lost: there is certainly then one negative root between -1 and 0. The remaining roots are then either both imaginary, or positive, and lying between 0 and 1: the least consideration of the equation will show that the former is the case.

Fourier's theorem is proved as follows:—changes of sign take place only when quantities become nothing or infinite; those before us cannot become infinite, and therefore the criterion can never be disturbed except when one or more of the set ϕx, $\phi_1 x$, &c. vanish. Now when any function ψx, vanishes, say at $x=a$, its previous sign must have been the contrary of that of its derived function, and its subsequent sign the same: that is, in passing from $a-h$ to $a+h$, h being very small, $\psi' x\times\psi x$ must pass from negative to positive. An algebraical proof may be given of this, but none which in clearness comes near to the following. The function $\psi' x\times\psi x$ is the derived function or differential coefficient of $\frac{1}{2}(\psi x)^2$, a positive quantity. Now if $\psi a=0$, $\frac{1}{2}(\psi x)^2$ must diminish (being positive) from $x=a-h$ to $x=a$, and increase from $x=a$ to $x=a+h$. But a differential coefficient is negative when its function diminishes with an increase of the variable, and positive when its function increases with an increase of the variable. Consequently $\psi' x\times\psi x$ is negative from $x=a-h$ to $x=a$, and positive from $x=a$ to $x=a+h$; as asserted. We now proceed to the proof of the theorem.

1. When $x=-\infty$, the criterion is $+-+-$ &c. or $-+-+$ &c.: and when $x=+\infty$, it is $+++$ &c. or $---$ &c. This follows immediately from the nature of the functions ϕx, $\phi_1 x$, &c., in which, when x is numerically great enough, the sign is always governed by that of its highest term. Thus, in some place or places, as many changes are certainly lost as there are units in the dimension of ϕx, *neither more nor fewer*.

2. When x passes through a root of ϕx, as many changes are lost as there are roots of ϕx equal to that root. Let there be only one root equal to a, so that $\phi_1 a$ does not vanish. We have then one or other of the following:—

	$x=a-h$	$x=a$	$x=a+h$		$x=a-h$	$x=a$	$x=a+h$
ϕx	$(+)$	0	$(-)$	ϕx	$(-)$	0	$(+)$
$\phi_1 x$	$-$	$-$	$-$	$\phi_1 x$	$+$	$+$	$+$
	One change lost.				One change lost.		

The signs in parentheses are those which follow from the theorem above proved. $\phi_1 x$ cannot change its sign in the process, for by hypothesis it does not vanish when $x=a$, and we take h so small that there shall be no root of $\phi_1 x$ between $a-h$ and $a+h$. At $x=a-h$, we must have $\phi_1 x\times\phi x$ negative, and at $x=a+h$ we must have it positive, by the theorem; which gives the signs in parentheses as marked.

Now let there be, say five roots equal to a, or let ϕa, $\phi_1 a$, $\phi_2 a$, $\phi_3 a$, $\phi_4 a$ all vanish, $\phi_5 a$ not vanishing. We must have then one or other of the following:—

	$x=a-h$	$x=a$	$x=a+h$		$x=a-h$	$x=a$	$x=a+h$
ϕx	$+$	0	$-$	ϕx	$-$	0	$+$
$\phi_1 x$	$-$	0	$-$	$\phi_1 x$	$+$	0	$+$
$\phi_2 x$	$+$	0	$-$	$\phi_2 x$	$-$	0	$+$
$\phi_3 x$	$-$	0	$-$	$\phi_3 x$	$+$	0	$+$
$\phi_4 x$	$+$	0	$-$	$\phi_4 x$	$-$	0	$+$
$\phi_5 x$	$-$	$-$	$-$	$\phi_5 x$	$+$	$+$	$+$
	Five changes lost.				Five changes lost.		

All the signs except those in the lowest line are dictated by the preliminary theorem. Thus $\phi_5 x$, in the first case, is negative by hypothesis; now $\phi_5 x$ is $\phi'_4 x\div 5$, so that $\phi_5 x\times\phi_4 x$ must be negative before $\phi_4 x$ vanishes, and positive afterwards. Hence $\phi_5 x$ continuing negative, $\phi_4 x$ must change from positive to negative. Again, $\phi_4 x\times\phi_3 x$ makes a similar change. The least consideration will show that, the signs in the lowest line being given, those in all the upper ones must be as written.

3. When intermediate functions vanish, changes of sign are never gained, but only lost; and are never lost but in even numbers. Suppose, for instance, that $\phi_1 a$ vanishes, but not ϕa nor $\phi_2 a$. We have then one of the four following:—

	$x=a-h$	$x=a$	$x=a+h$		$x=a-h$	$x=a$	$x=a+h$
$\phi_1 x$	+	+	+	ϕx	−	−	−
$\phi_2 x$	−	0	−	$\phi_1 x$	+	0	−
$\phi_3 x$	−	−	−	$\phi_2 x$	−	−	−
	No change lost.*				*Two* changes lost.		
$\phi_2 x$	−	−	−	ϕx	+	+	+
$\phi_3 x$	−	0	+	$\phi_1 x$	−	0	+
$\phi_4 x$	+	+	+	$\phi_2 x$	+	+	+
	No change lost.*				*Two* changes lost.		

The signs in the middle lines are dictated by the preliminary theorem. Next let $\phi_4 a$, $\phi_5 a$, $\phi_6 a$, $\phi_7 a$ vanish, but not $\phi_3 a$ nor $\phi_8 a$. We have then, by the preliminary theorem, one or other of the four following:—

	$x=a-h$	$x=a$	$x=a+h$		$x=a-h$	$x=a$	$x=a+h$
$\phi_3 x$	+	+	+	$\phi_3 x$	−	−	−
$\phi_4 x$	−	0	−	$\phi_4 x$	−	0	−
$\phi_5 x$	+	0	−	$\phi_5 x$	+	0	−
$\phi_6 x$	−	0	−	$\phi_6 x$	−	0	−
$\phi_7 x$	+	0	−	$\phi_7 x$	+*	0	−
$\phi_8 x$	−	−	−	$\phi_8 x$	−	−	−
	Four changes lost.				Four changes lost.		
$\phi_3 x$	−	−	−	$\phi_3 x$	+	+	+
$\phi_4 x$	+	0	+	$\phi_4 x$	+	0	+
$\phi_5 x$	−	0	+	$\phi_5 x$	−	0	+
$\phi_6 x$	+	0	+	$\phi_6 x$	+	0	+
$\phi_7 x$	−	0	+	$\phi_7 x$	−	0	+
$\phi_8 x$	+	+	+	$\phi_8 x$	+	+	+
	Four changes lost.				Four changes lost.		

The same conclusions will be found from other cases, and we have now examined every way in which the criterion can undergo an alteration in the order of the signs of which it is composed. And since, the function being of n dimensions, there are altogether n changes, and n only, to lose, it follows that every pair of signs lost by the vanishing of any of the derived functions, in any internal part of the criterion, shows that there must be two imaginary roots: for there must be n roots only, every root must be accompanied by a change lost at the head of the criterion, and every loss of changes which takes place anywhere else diminishes the number which can take place at the head. Again, since losses other than at the head of the criterion must take place in even numbers, it follows that of any odd number of losses, one must have been effected at the head, or must have arisen from a real root; or if not one, some other odd number.

The manner in which the changes of sign take place is as follows:— When $x=-\infty$, or even when it is numerically greater than any negative root, the criterion presents nothing but changes. Alterations of the criterion consist in: 1, Loss of one or more changes at the head of the criterion (showing real roots); 2. loss of changes in even numbers in the middle of the criterion (showing imaginary roots); 3, elevation of changes, or alteration of their place in a direction towards the head of the criterion. This last takes place only when an *odd* number of derived functions vanishes, the including functions (preceding and following) having different signs. As soon as a root has been passed, there is a permanency ++ or −− at the head of the criterion: before another root is arrived at, this permanence must have become a change, since a change there must then be at the head to be lost in passing through the root. Hence it follows that between two roots of $\phi x=0$, there must lie a root of $\phi' x=0$; and this root is either single, triple, quintuple, &c., but not double, quadruple, &c.

For example, let $\phi x=x^4-7x^3+15x^2-10x+2$,
$\phi_1 x=4x^3-21x^2+30x-10$, $\phi_2 x=6x^2-21x+15$,
$\phi_3 x=4x-7$, $\phi_4 x=1$.

There are no negative roots, as is obvious from their being nothing but changes among the coefficients; if we construct the criteria for $x=0$, 1, 2, 3, and 4, we find the following results:—

	0	1	2	3	4
ϕx	+	+	+	−	+
$\phi_1 x$	−	+	−	−	+
$\phi_2 x$	+	0	−	+	+
$\phi_3 x$	−	−	+	+	+
$\phi_4 x$	+	+	+	+	+

* Observe that in these cases a change is removed to a higher place in the series, nearer to the head of the criterion.

When $x=0$, the criterion shows four changes; when $x=1$, it is indefinite, owing to $\phi_2 1=0$. But immediately before $x=1$, $\phi_2 x$ must, by the preliminary theorem, have the sign contrary to that of $\phi_3 x$, or the sign +; consequently at $x=1-h$, however small h may be, the criterion has + + + − +. Two changes of sign are therefore lost in passing from $x=0$ to $x=1$, and there are either two real roots between 0 and 1, or two imaginary roots. To try this further, let $x=\frac{1}{2}$, the criterion of which is − + + − +; so that there is one root between 0 and $\frac{1}{2}$, and another between $\frac{1}{2}$ and 1. When $x=1+h$, the criterion is + + − − +, so that there is no root between 1 and 2. Lastly there is one root between 2 and 3, and one between 3 and 4.

The theorem of Fourier, though very convenient in practice, is defective in theory, as requiring an unlimited number of trials. If two roots were very nearly equal, it would require very minute subdivision of the interval in which they are first found to lie, to distinguish them from a pair of imaginary roots. This theorem was not published till 1831, in Fourier's posthumous work, but its author had made his methods known, and among others to M. Sturm, a young Genevese, employed in the bureau of M. de Férussac, editor of the bulletin which bore his name, now a member of the Institute, and enjoying a reputation which may excuse this mention of the circumstances of his private life. Sturm applied himself to the detection of functions which should stand in the place of ϕx, $\phi_1 x$, $\phi_2 x$, &c., in such manner that the criterion formed from them, in the same way as in Fourier's theorem, should never lose a change of signs except in passing through a real root. In this he signally succeeded: and thus, though his theorem presents great practical prolixity of detail, he furnished a complete solution of the difficulty which had occupied analysts since the time of Descartes. This theorem may be proved as follows:—

Let there be any number of functions $V, V_1, V_2, \ldots V_r$, the last of which is a constant independent of x, and all but the last functions of x. Let them be connected together by the equations—

$$V=P_1V_1-V_2,$$
$$V_1=P_2V_2-V_3,$$
$$V_2=P_3V_3-V_4,$$
$$\cdots\cdots\cdots$$
$$V_{r-2}=P_{r-1}V_{r-1}-V_r$$

$P_1 P_2$, &c. being any functions of x, which do not become infinite when $V_1 V_2$, &c. vanish. From this it follows, first, that no two consecutive functions of the set V, V_1, &c. can vanish together: for if V_2 and V_3, for instance, vanished together, the third equation shows that V_4 would also vanish, the fourth that V_5 would vanish, and so on: consequently V_r, a given constant, also vanishes, which is absurd. Secondly, when any one after V vanishes, the preceding and following must have different signs; for $V_1=0$ gives $V=-V_2$, $V_2=0$ gives $V_1=-V_3$, &c. Now call the signs of V, V_1, &c. the criterion, and let $V=0$ when $x=a$, there being only one root of that value, so that V changes sign in passing from $x=a-h$ to $x=a+h$. Since V_1 does not vanish with V, we have one of the four cases following:—

	$x=a-h$	$x=a$	$x=a+h$	$x=a-h$	$x=a$	$x=a+h$
V	−	0	+	+	0	−
V_1	−	−	−	−	−	−
V	−	0	+	+	0	−
V_1	+	+	+	+	+	+

If V_1 be the derived function of V, only the second or third cases can happen, by the theorem so often used in the preceding part of this article; so that a change of sign must be lost at the head of the criterion for every single root of $V=0$. Nor will any change of sign ever be gained or lost in any other manner: for suppose $x=a$ gives $V_4=0$, for instance, then V_3 and V_5 have different signs, and in passing from $x=a-h$ to $x=a+h$, if each be so small that no root of V_3 or V_5 lies between $a+h$ and $a-h$, we must have one of the eight following cases:—

	$x=a-h$	$x=a$	$x=a+h$	$x=a-h$	$x=a$	$x=a+h$
V_3	−	−	−	+	+	+
V_4	±	0	±	±	0	±
V_5	+	+	+	−	−	−

In no one of these is any change of sign lost, or any thing except a change and a permanence when $x=a-h$, and a

change and a permanence, in a different order perhaps, when $x=a+h$. Consequently, if in passing from $x=a$, the less, to $x=b$, the greater, it appear that no changes of sign are lost, it is certain that there must have been no real root of $V=0$ between $x=a$ and $x=b$.

Now, V_1 being the derived function of V, it remains to find V_2, V_3, &c. Divide V by V_1, which is of one dimension lower, and we have a quotient, say P_1, and a remainder R_1. Then $V=P_1 V_1+R$ or $V_2=-R$. Again, divide V_1 by V_2, giving a quotient P_2, and a remainder R_2: we have then $V_1=P_2 V_2+R_2$ or $V_3=-R_2$; and so on. It appears, then, that V_1 being the derived function of V, we must proceed as in finding the greatest common measure of V and V_1, only changing the sign of every remainder as fast as it is obtained. In order that the last, V_r, may be a finite constant, it is requisite that there should be no equal roots. We must then suppose the equal roots to be separated beforehand, as in the usual method. In fact, this very process of finding the greatest common measure, with or without change of sign in the remainders, will first detect the equal roots, if any. It is important to remark, that at any step multiplication by any positive quantity is allowable, the signs (the only things we have to do with) not being in any case altered by such multiplication.

In Involution and Evolution a method of performing the operations required in Sturm's theorem was proposed, which avoids useless writing. Mr. Young (*Math. Dissertations*, p. 143) has since proposed another, of much the same degree of abbreviation. Sturm's theorem however requires so much operation, that there can be little doubt of that of Fourier being a more easy mode of working any particular case. It is not however as a key to the mere numerical solution of equations that either of these theorems must be viewed: the insight which they give into the nature of equations, and still more that which they are likely hereafter to give (for neither is more than a germ), will render them both important steps in the progress of algebra.

Since all that is necessary to the theorem is that the last function V_r should retain one sign, and not vanish, we may stop in the process when we arrive at any function of which all the roots are known, or can be discovered, to be impossible. And it is easily shown that even when there are equal roots, so that the last, V_r, is neither constant, nor always of the same sign, the theorem still remains true, so far as to give the number of ***different*** roots which lie between any two given limits, without any information as to the number of times which each root should be repeated.

For instance, in the article cited we find

$$V=x^4-3x^3-2x^2+x-3$$
$$V_1=4x^3-9x^2-4x+1$$
$$V_2=43x^2+45$$

We need not go further, for V_2 has none but imaginary roots. Now, when $x=-\infty$, the criterion is $+-+$; when $x=0$, it is $-++$; and when $x=+\infty$, $+++$. Consequently there is one negative root, one positive root, and a pair of imaginary roots.

The following example is from Mr. Young (p. 191): it is an instance given by Fourier in illustration of his own method, and Sturm's is applied to it by Mr. Young, to show the superior certainty of the latter. Of that certainty no one can doubt, but the process exhibited in the page cited is such as will never come into general use unless the work can be made more easy:—

$$V=x^7-2x^5-3x^3+4x^2-5x+6$$
$$V_1=7x^6-10x^4-9x^2+8x-5$$
$$V_2=2x^5+6x^3-10x^2+15x-21$$
$$V_3=52x^4-70x^3+123x^2-163x+10$$
$$V_4=-4403x^3+8862x^2-19810x+20531$$
$$V_5=200865x^2+489790x-1169472$$
$$V_6=187355x-270632$$
$$V_7=\text{ a positive constant.}$$

Here the criteria for $x=-\infty$, $x=0$, $x=+\infty$ are

$x=-\infty$ $-+-+++-+$ five changes
$x=0$ $+--++--+$ four changes
$x=+\infty$ $++++-+++$ two changes.

There are then one negative root and two positive roots, and therefore four imaginary ones. The reader will easily find that the positive roots lie between 1 and 2, and the negative root between -1 and -2. The exhibition of the process, leaving out the actual performance of multiplications, has 400 figures in Mr. Young's work. Fourier has merely written down the derived functions, which is done at sight and formed the criteria for $x=-10$, $x=-1$, $x=-h$, $x=0$, $x=+h$, $x=1$, $x=10$, which may all be done at sight also. From this he finds that there must be one negative root between -1 and -10, that there may be two roots between 0 and 1, and two more between 1 and 10. All this might be done before V_4 could be found and written down as above. It is to be hoped either that Fourier's theorem will be completed by the addition of a test for imaginary roots, or that Sturm's functions will be exchanged for others of less complicated operation. But in the meanwhile it must be remembered that Fourier, Sturm, and Horner have, in thirty years, completely changed the aspect of the solution of numerical equations: at the beginning of the period mentioned, it would have been thought too good to expect that any certain method of predicting, or easy one of calculating, the roots of such equations, should be found, after the failure of all analysts from Des Cartes and Newton down to Euler and Lagrange, the best heads of France and England, Germany and Italy. It is a lesson against despairing of the attainment of any result, however illustrious the investigators who have not succeeded, and also against imagining that the hints of preceding ages are exhausted. All the contents of the present article arise out of a new mode of looking at the theorem which Des Cartes gave two hundred years ago.

STURMINSTER. [Dorsetshire.]

STU'RNIDÆ, Mr. Vigors's name for the *Starling Family*, belonging to his order Insessores.

Linnæus placed his genus *Sturnus*, consisting of only five species, among which the Water-Ouzel appears as *Sturnus Cinclus*, between *Alauda* and *Turdus*, in his order *Passeres*. Cuvier arranges the Starlings between the *Cassiques* (*Cassicus*) and the Crows (*Corvus*).

Mr. Vigors, who assigns to the *Sturnidæ* a place between the *Fringillidæ* and the *Corvidæ*; in his Conirostres, observes that this family embraces a considerable number of groups, approaching each other in their gregarious and migratory habits. They are, he remarks, found in every part of the globe united in large flocks, carrying destruction among the cultivated fields, and following herds of cattle for the sake of the insects or grains which they may pick up from their bodies or in their neighbourhood. 'In addition to the American genus *Icterus*,' continues Mr. Vigors, 'and the contiguous genera *Cassicus* and *Xanthornus* of M. Brisson, together with *Pendulinus*, Vieill., and several corresponding groups, we may observe the genus *Amblyramphus*, Leach, united to the family, as also the *Buphaga*, Linn., and *Pastor* and *Lamprotornis*, which M. Temminck has separated from the *Thrushes*. The whole of the family, united by their manners and the straight and conical form of the beak, the ridge of which passes back to some extent over the forehead, may be observed, by those who cast even a casual glance over the three adjoining groups, to hold an intermediate rank between the weaker conformation of the *Fringillidæ* and the more powerful structure of the *Corvidæ*.' And he passes into the family of *Corvidæ* by the genus *Nucifraga*. [Nutcracker.]

Such is Mr. Vigors's opinion, expressed in his paper on the *Affinities which connect the Orders and Families of Birds*. (*Linn. Trans.*, vol. xiv.)

Mr. Swainson proceeds from the Crows to the Starlings, but he acknowledges that the unarranged state of the last group prevents him from knowing the genus by which this passage is truly effected. He remarks that the various birds assimilated by ornithologists to our European Starling are generally of the same size, and that they appear in fact like a smaller race of crows, which they very much resemble in manners and in structure; in the latter respect they are, he observes, evidently much weaker; and he goes on to notice their habits of seeking their food generally upon the ground, of living in societies, and of preferring plains frequented by cattle. The three principal groups he thinks well characterised. 'In the first the margins of the bill form a distinct angle at the base, which is very wide; the gape extends beneath the eye, and the tips are slightly notched: these are the true starlings (*Sturninæ*). In the second the bill is shorter, more compressed, and very much resembles that of a thrush, being almost destitute of the basal angle: this subfamily comprehends the true grakles (*Lamprotorninæ*), and is remarkable for the metallic lustre of its dark-coloured plumage. The third or aberrant division includes the boat tails (*Scaphidurinæ*), the hang-nests (*Icterinæ*), and the maize-birds (*Agelainæ*), all of which

are characterised by a perfectly entire finch-like bill, more or less conic, but of different lengths.'

In the *Scaphidurinæ*, with which Mr. Swainson commences, we have, he remarks, the largest birds in the whole family; those in short which even a scientific observer might easily mistake for real crows. Their name is given to them from the singular structure of their graduated tail, which becomes so concave on its upper surface by the oblique folding on its sides, as to resemble a boat in form. Mr. Swainson, after stating that all the true species of this group are natives of America, and resemble the crows in the glossy blackness of their plumage, expresses his opinion that they are the rasorial division of the family. But, he adds, there is a bird from New Guinea, *Astrapia gularis*, Vieill. [CORVIDÆ, vol. viii, p. 72], which, from exhibiting the greatest development of this structure, might be taken for the type, if its bill and general habit did not evince an approximation to the *Lamprotorninæ*. *Astrapia*, he remarks, had been associated by all writers, except M. Temminck and M. Vieillot, with the Paradise-birds, from the uncommon brilliancy of its plumage.

The next subfamily, or *Lamprotorninæ*, comprise, according to Mr. Swainson, many smaller groups whose characters have not yet been sufficiently investigated; whilst others, which he conceives to belong to this family, have been placed with the crows. He does not seem altogether satisfied with the position which he has assigned to *Astrapia*, for he remarks that this magnificent bird, but for its long boat-shaped tail, would certainly be ranked with this group, f which, after all, he thinks that it may probably prove to the rasorial genus. He then sums up the chief peculiarities of the grakles, viz. the strong thrush-like bill, generally notched, but never angulated at the base, and the remarkably large and stout feet, and the general blackness of their plumage relieved by the most beautiful metallic lustres of green and blue. The whole group appears to him to be confined to the tropics of Asia and Africa, where, he thinks, they seem to represent the boat-tails. To this group he removes the Australian Satin birds (*Ptilonorhynchus*, Kuhl), and the Mainots, since the *Pastor musicus* at once shows, in his opinion, the natural stations and affinities of all these birds.

Mr. Swainson finds the passage to the *Sturninæ*, or true Starlings, easy and natural, as he traces in the mainots many of the characters of the grakles united with those of the *Pastor* starlings. In the *Sturninæ* the bill is much more straight, and the under mandible considerably thickened at the base, where the commissure forms an abrupt angle. Mr. Swainson notices the great strength of the legs in these birds, indicating their walking propensities exerted in following the tracks of cattle in order to search after such insects as are disturbed by their grazing. He adverts to the association of crows and starlings in the same field, nearly in the same flock, and almost adopting the same habits, each bird representing the other in its own particular family; in both, he remarks, the lengthened and conic form of the bill is well adapted for searching after insects in the ground; both walk in the same stately manner, and both seem so attached to cattle and sheep as to rest upon their backs. The common starling may sometimes walk stately, but when we have observed it hunting assiduously for its insect food, the gait is more like a hurried run than a stately walk. But to return to Mr. Swainson; he remarks that the genus Pastor has the bill compressed, but in the European Starlings (*Sturnus*) that organ is more acute and depressed; the notch also, he adds, is so faint as to be nearly obsolete. In concluding his observations on this subfamily, he adverts to some of the foreign Pastors leading to *Gracula*, Cuv., as being furnished with naked wattles, and as appearing to be providentially created to destroy the devastating flights of locusts which so often appear on the plains of Southern Africa.

The same author makes the *Agelainæ*, or Maize-birds, succeed to the true starlings; and he thinks that the two subfamilies are so completely united by the *Sturnella collaris* (collared starling of South America), that but for the discovery of the genus *Oxystomus*, it would be difficult to say in which group *Sturnella* should be placed. Mr. Swainson observes that we now enter upon a group which he considers so truly natural, that his surprise is excited in no small degree by the confused notions of certain writers regarding their distinctions. To ignorance of the natural habits of these birds, or a disregard of that peculiarity of structure which would in some respects point out their habits, he attributes their being considered as part of the hang-nests (*Icteridæ*) by most writers, and their being actually united to them and the *Quiscalinæ* in the same genus by Wagl. r The fact however, in Mr. Swainson's opinion, seems to be that nature has distinctly separated the American orioles of Linnæus into three great groups, yet that she unites them so completely by insensible gradations, that unless the whole are analysed, their true distinctions will never be detected. As in the case of the boat-tails and hang-nests, the *Agelainæ* are, Mr. Swainson tells us, confined to America, and he is consequently enabled to say something of them from personal observation. 'Whenever,' says Mr. Swainson, 'during our travels through the wilds of Brazil, we reached the *corals*, or cattle enclosures, we were sure to meet with these birds; of which many species (in general very obscurely known) are found in all parts of that empire. The primary character therefore of the maize-birds is, that they are *terrestrial*, while those of the next family are *arboreal;* and both these peculiarities are rendered sufficiently apparent by external structure. In the maize-birds the feet, like those of the starlings, are strong and lengthened; and the elevation of the tarsi at once proclaims their habits. This structure is carried to its maximum in the Mexican *Agelaius longipes*, Sw., and in the North American *Agelaius icterocephalus*, Bonp. (Bonap. ?). There is still another characteristic of these birds: to enable them to retain a firm hold on the smooth stems of the maize and other grain upon which they feed, their claws are slender and acute, while the tail (always bent downward when the bird is in such an attitude) is frequently worn at its extremity. In the scansorial genus *Dolichonyx*, Sw., this habit is actually accompanied by the scansorial structure of the tail, the feathers of which are rigid and pointed. The most interesting genus of this group is the *Molothrus pecoris*, or cow-bunting of Wilson, the only bird, except the cuckoo, which deposits its eggs in the nests of other birds.' [MOLOTHRUS, where it is stated by mistake that Mr. Swainson has placed the form in the subfamily *Icterinæ*.]

The fifth and last division of the *Sturnidæ* consists, according to the arrangement of Mr. Swainson, of the *Icterinæ*, or *Hang-nests*, and he remarks that they are so intimately connected with it, that naturalists had not hitherto been aware of their true distinction. The group is strictly South American, gregarious, wary, and ingenious; building long purse-shaped nests, suspended from the slender branches of lofty trees: yet, says Mr Swainson in continuation, unlike all the preceding genera, these birds are never seen upon the ground, and though the legs are robust, they are short, with broad, strong, and fully curved claws. He finds the subordinate types well distinguished by slight but perfectly characteristic differences in the form of the bill, wings, and tail; the full perfection of the group being seen in *Icterus*, not, as it has been thought, in *Cassicus*, which, according to Mr. Swainson's views, is the rasorial type. *Buphaga* is excluded by the same author from the *Sturnidæ*, and placed among the *Certhiadæ*; and he passes from *Agelainæ* to *Fringillidæ*, and from *Fregilinæ* among the *Corvidæ* to *Buceridæ*, the circles touching each other at *Scaphidurinæ* and *Glaucopinæ*, as they appear in Mr. Swainson's *Synopsis*.

Sturnidæ. *Starlings*.

Family Character.—Size smaller than that of the *Corvidæ*. Stature less robust. Bill angulated at the base; the upper mandible entire. Lateral toes equal. (Sw.)

Subfam. *Sturninæ*.

Subfamily Character.—Bill in the form of a lengthened cone; longer than the head; the commissure with an acute angle at the base.

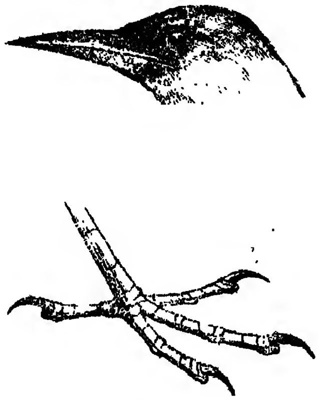
Genera.

Sturnus, Linn.—Bill depressed from the base as far as the tip, which is slightly inflexed, and obsoletely notched. Culmen convex and rounded. Wings lengthened, pointed; the first quill minute and spurious; the second and third longest. Tail short, divaricated. Feet moderate, terrestrial. The lateral toes equal; the middle toe as long as the tarsus; hinder toe shorter. The conirostral type. (Sw.)

Example, *Sturnus vulgaris, the common Starling*.

Pastor, Temm.—Bill depressed only at the base, compressed beyond; culmen slightly bent. Tip of the upper mandible deeply notched. Commissure distinctly angulated at the base. Nostrils large, feathered. Wings moderate in length, ample in breadth: first quill very minute;

the second nearly equal to the third. Tail short, broad, rounded. Feet very large and strong. Middle toe as long as the tarsus; hinder shorter; lateral toes equal. Claws somewhat slender, acute, but not much curved.



Head and foot of Starling.

Locality.—Warm latitudes of the Old World. The dentirostral type. (Sw.)

Example, *Pastor roseus*, the Rose-coloured Ouzel. Not unfrequently seen in Britain.

Gracula, Auct. [ROLLERS, vol. xx., p. 68.]

Acridotheres, Vieill.—General structure of *Pastor*; but the whole of the head entirely naked, and furnished with fleshy crests and wattles. Nostrils large, naked. Feet moderate. Tail even. Bill very wide at the base. The tenuirostral type. (Sw.) Example, *Acridotheres carunculatus*.

Oxystomus, Sw.—Bill much lengthened, longer than the head: the sides are compressed. Culmen flattened, nearly straight, and angulated on each side; the base advancing very far upon the head, and dividing the frontal feathers. Nostrils placed in a large depression towards the base of the bill. Wings very short and considerably rounded. Tail moderate, rounded; all the feathers, and the secondary quills, ending in setaceous points. Legs long and robust. Tarsus much longer than the middle toe; lateral toes unequal, the inner shortest. Pacific Islands. The scansorial type. (Sw.) Example. *Oxystomus carunculatus*.

Subfam. *Lamprotorninæ*. *Grakles*.

Subfamily Character.—Bill thrush-like, compressed: the culmen curved from the base. Lateral toes unequal.

Genera.

Ptilonorhynchus.—Size large. Bill short, very thick, convex above: both mandibles distinctly notched. Nostrils placed half-way between the gape and the tip, partly concealed by the short thick-set feathers of the front, which lie on the basal half of the bill. Wings rather short, rounded; the first and second quills graduated; the third shorter than the fourth and fifth, which are the longest. Tail moderate; the feathers broad, their tips truncated. Feet ambulating, large, and very strong. Middle toe and tarsus of equal length, hinder toe very strong, but much shorter; lateral toes unequal, the outer longest, and united to the middle as far as the first joint. Australia. (Sw.)

Example, *Ptilonorhynchus holosericeus*.

Lamprotornis, Temm. *Grakle.*—Bill thrush-like, compressed its whole length. Culmen curved from the base to the tip. Upper mandible notched. Commissure slightly curved. Nostrils midway between the tip and the gape, *naked, but with the frontal feathers reaching to their base.* Wings long, ample: the first quill spurious; the third, fourth, and fifth of equal length, and longest. Tail short, even, rounded, or (as in the rasorial type) considerably lengthened and cuneated. Feet very large and strong. Middle toe and tarsus equal; hinder strong, but much shorter; lateral toes unequal. (Sw.)

Example, *Lamprotornis ptilonorhynchus*. 'Birds of West Africa,' i. 140.

Subfam. *Scaphidurinæ*. *Boat-tails.*

Subfamily Character.—Bill of a very lengthened conic shape, entire, and compressed: the culmen slightly curved. Tail graduated, the sides reflected upwards, or boat-shaped. Feet strong. (Sw.)

Genera.

Astrapia (ante, p. 173).

Scaphidura, Sw.—Bill longer than the head, conic. Both mandibles equally thick. The base of the culmen broad, flattened, and advancing very far on the front of the head. Commissure angulated at the base, and sinuated on the sides. Nostrils basal, placed in a small triangular hollow on the sides; the membrane obsolete. Wings lengthened, pointed: the first quill longest. Tail moderate, graduated, boat-shaped. Feet strong. Middle toe and tarsus of equal length; hinder toe much shorter; inner toe hardly shorter than the outer. South America. (Sw.)

Example, *Scaphidura Barita*.

Quiscalus, Vieill.—Bill longer than the head, compressed. Both mandibles equally thick. Culmen slightly curved, and compressed from the base, where it simply divides the frontal feathers, without being dilated. Commissure considerably sinuated. Nostrils broad, naked; the aperture round. Wings moderate, somewhat pointed: the two first quills slightly shorter than the third and fourth, which are the longest. Tail rather lengthened, much graduated, boat-shaped; tips of the lateral feathers truncated. Feet large, strong. Middle toe and tarsus equal: hinder toe shorter; inner toe scarcely shorter than the outer. America. (Sw.) Example, *Quiscalus versicolor*.

Scolecophagus, Sw.—Bill shorter than the head, straight, slender; the margin inflexed, but not sinuated. Wings moderate, pointed; the first quill rather shorter than the second. Tail divaricated, flat, and slightly rounded. Legs lengthened, slender, formed for walking. Middle toe and tarsus of equal length; hinder toe shorter: lateral toes of equal length. Claws slender, acute, slightly curved. (Sw.)

Example, *Scolecophagus ferrugineus*.

Subfam. *Icterinæ*. *Hang-nests*.

Subfamily Character.—Bill completely conic, entire, rather shorter than the head, either straight or with both mandibles slightly bent. Feet formed for grasping. The claws thick, broad, and much curved. (Sw.)

Genera.

Cassicus, Daudin. *Cassicans.*—Bill rather longer than the head; the base thick, very convex, and enlarged into a broad oval plate, which advances very far on the front, and divides the frontal feathers. Nostrils oval, naked, basal, pierced in the solid substance of the bill, and close to the margin of the upper mandible. Commissure straight, but angulated at the base. Wings rather long; the first and second quills graduated. Tail graduated. Feet short, very strong. Hind toe and claw nearly as long as the tarsus. Tropical America. (Sw.)

Zanthornis (Xanthornus), Cuv.—Bill not longer than the head, generally shorter, perfectly straight; the culmen not dilated at the base, but simply dividing the frontal feathers. Wings moderate, pointed; the first three or four quills generally or nearly equal. Tail moderate, rounded. Feet moderate, but with the hinder toe manifestly longer than the tarsus; lateral toes unequal. America. (Sw.)

Example, *Xanthornus Baltimorii*.

Icterus, Cuv.—Bill somewhat lengthened, as long as the head, or longer: both mandibles slightly curved, and considerably attenuated. Nostrils basal, rather large, covered above by a membrane; the aperture lateral and oval. Wings moderate; the first and second quills rather shorter than the third. Tail somewhat lengthened, graduated. Feet moderate. Inner toe shorter than the outer; hinder toe shorter than the tarsus. Example, *Icterus castaneus*.

Chrysomus, Sw.—Bill resembling *Zanthornis* (Xanthornus must be meant); but the margin of both mandibles inflexed. Wings moderate; the first quill rather shorter than the second. Tail rounded. Feet formed for walking. Toes large, very long and slender; middle toe longer than the tarsus; lateral toes equal; hinder toe shorter than the tarsus. Claws long, very slender, and but slightly curved. (Sw.) Example, *Chrysomus icterocephalus*.

Subfam. *Aglainæ*. (Agelainæ?) *Maizers*.

Subfamily Character.—Bill short, thick, entire, completely conic, sometimes depressed, and rounded at the tip. Culmen rather broad, and flattened at the base. Legs long, slender, formed for walking.

Genera.

Dolichonyx, Sw.—Bill very short, finch-like, conic, entire, shorter than the head; the commissure sinuated. Wings pointed; the first and second quills longest and nearly equal. Tail slightly graduated, subscansorial; the tips acuminated, and somewhat rigid. Legs long, slender. Middle toe longer than the tarsus; lateral toes unequal, the

inner longest; hind toe of equal length with the tarsus. Claws long, very slender, and slightly curved. (Sw.)

Example, *Dolichonyx oryzivorus.* [BOB-O-LINK.]

Agelaius, Vieill. - Bill short, very conic, entire: the tips compressed: the culmen flattened towards the base; sides of the mandibles inflexed. Wings lengthened; the two first quills longest. Tail slightly rounded. Legs long, slender. Middle toe nearly as long as the tarsus. Claws long, very slender, and but slightly curved. America. (Sw.)

Example, *Agelaius pustulatus.*

Leistes, Vigors.- Bill lengthened, conic, very straight; the culmen depressed from the base to the tip, which is flattened. Wings moderate; the first quill rather shorter than the three next, which are the longest. Tail rounded. Legs large, strong. Middle toe longer than the tarsus: hinder toe shorter; lateral toes unequal, the outer one smaller than the inner: the hinder claw much stronger and more curved than the middle one. (Sw.) Example, *Leistes erythrocephalus.*

Molothrus, Sw. *Cowpen.* Example, *Molothrus pecoris.* [MOLOTHRUS.]

Sturnella, Vieillot.—Bill long, equal to the length of the head, conic, much depressed towards the tip, where it is broader than high: culmen dividing the frontal feathers, where it is depressed and flattened. Wings moderate; first quill rather shorter than the second. Tail short, rounded; the feathers rather narrow. Feet large, but slender. Tarsus longer than the middle toe. Lateral toes unequal, the outer shortest: hind toe not much shorter than the middle. Anterior claw small, and of equal size; hinder claw (typically) twice as long as the others. (Sw.)

Example, *Sturnella collaris.* (*Classification of Birds.*)

The family is immediately succeeded in Mr. Swainson's arrangement by the *Fringillidæ*, to which some of the species placed by him among the *Sturnidæ*, but by others among the Finches (*Dolichonyx*, for example), would seem rather to belong.

The Prince of Canino, in his *Birds of Europe and North America*, places the *Sturninæ* in his family *Corvidæ*, next to *Corvinæ* and arranges under the *Sturninæ* the genera *Acridotheres, Quiscalus, Scolecophagus, Sturnella, Icterus, Agelaius, Molothrus*, and *Dolichonyx.*

Mr. G. R. Gray (*Genera of Birds*) makes the *Sturnidæ*, which are immediately succeeded by the *Fringillidæ*, as they are in the Prince's method, follow the *Corvidæ.*

Mr. Gray divides the *Sturnidæ* into the following subfamilies:—

1. *Lamprotorninæ.*

Genera:—*Ptilonorhynchus*, Kuhl (*Pyrrhocorax*, Vieill.; *Kitta*, Kuhl); *Chlamydera*, Gould (*Ptilonorhynchus*, Jard.; *Calodera*, Gould); *Lamprotornis*, Temm. (*Turdus*, Lath.; *Lamprotornis*, Temm.); *Juida*, Less. (*Lamprocolius*, Sundev.; *Lamprotornis*, Temm.); *Megalopterus*, Smith; *Sturnia*, Less. (*Turdus*, Gm.; *Lamprotornis*, Sw.); *Aplonis*, Gould (*Turdus*, Lath.); *Cochoa*, Hodg.

2. *Buphaginæ.*

Genus, *Buphaga*, L.

3. *Sturninæ.*

Genera:—*Pastor*, Temm. (*Psaroides*, Vieill.; *Boscis*, Rehm.; *Turdus*, L.); *Acridotheres*, Vieill. (*Cossyphus*, Dum.; *Gracula*, Gm.); *Psarolophus*, Jard. and Selby (*Pastor*, Gould; *Oriolus*, Hodgs.); *Cutia*, Hodgs.; *Dilophus*, Vieill. (*Sturnus*, Lath.; *Pastor*, Temm.: *Acridotheres* (Vieill.), Swains.: *Gracula*, Gm., Cuv.): *Creadion*, Vieill. (*Sturnus*, Lath.; *Oxystomus*, Swains.: *Philesturnus*, J. Geoff.: *Philedon*, Cuv.; *Icterus*, Less.): *Sturnus*, L.; *Sturnella*, Vieill. (*Cassicus*, Daud.; *Alauda* et *Sturnus*, L.): *Amblyrhynchus*, Leach (*Oriolus*, Gm.; *Sturnella*, Vieill.; *Leistes*, Sw.).

4. *Quiscalinæ.*

Genera:—*Astrapia*, Vieill. (*Paradisea*, L.; *Lamprotornis*, Temm.); *Scolecophagus*, Sw. (*Gracula*, Wils.; *Quiscalus*, Bonap.; *Chalcophanes*, Wagl.); *Quiscalus*, Vieill. (*Icterus*, Temm.; *Quiscala*, Licht.; *Chalcophanes*, Wagl.; *Scaphidura*, Sw.); *Cassidix*, Less. (*Oriolus*, Gm.); *Scaphidura*, Sw. (*Gracula*, Gm.; *Quiscula*, Licht.; *Icterus*, Temm.; *Chalcophanes*, Wagl.).

5. *Icterinæ.*

Genera:—*Cassicus*, Briss. (*Icterus*, Temm.; *Xanthornus*, Pallas; *Psarocolius*, Wagl.; *Oriolus*, L.); *Cassiculus*, Swains. (*Icterus*, Bonap.; *Xanthornus*, Jard. and Selby); *Xanthornus*, Briss. (*Psarocolius*, Wagl.; *Yphantes* et *Pendulinus*, Vieill.; *Oriolus*, L.); *Icterus*, Briss. (*Oriolus*, L.; *Pendulinus*, Vieill.; *Psarocolius*, Wagl.); *Chrysomus*, Sw. (*Pendulinus*, Vieill.; *Oriolus*, L.).

6. *Agelainæ.*

Genera:—*Molothrus*, Swains. (*Emberiza*, Gm.; *Passerina*, Vieill.; *Psarocolius*, Wagl.; *Agelaius*, Swains.); *Leistes*, Vigors (*Agelaius*, Vieill.; *Psarocolius*, Wagl.; *Xanthornus*, Quoy et Gaim.; *Icterus*, Licht.); *Agelaius*, Vieill. (*Oriolus*, L.; *Sturnus*, Wils.; *Icterus*, Briss.; *Psarocolius*, Wagl.); *Dolichonyx*, Swains. (*Emberiza*, L.; *Passerina*, Vieill.; *Icterus* et *Emberizoides*, Bonap.; *Psarocolius*, Wagl.).

We have here given the views of some of the principal ornithologists relative to the family of starlings; and we think no one can peruse it without being struck with the uncertain state in which this department of natural history, in common with too many others, is, and the absolute necessity that exists for a reform of the nomenclature. How that reform is to be brought about is a problem of no small difficulty. A proposed plan for rendering the nomenclature of zoology uniform and permanent, which it is the intention of the proposers to submit at a future period to the consideration of the British Association for the Advancement of Science, has been sent to us, and, after a careful perusal of the scheme, we think that it rests upon sound principles; but the proposers must be prepared—indeed they seem to be so—for no light labour; nor will the measure ever be anything like complete till they can induce the zoologists of all other civilised parts of the world to go hand in hand with them. If they succeed in carrying out their measure to a full, satisfactory, and permanent conclusion, they will earn the merited praise of every one who is interested in the science. Previous to their submission of their plan to the British Association, the proposers are anxious to mature it as much as possible by obtaining the opinions of eminent zoologists in various countries: and they state that they will feel grateful for any remarks or criticisms with which they may be favoured, addressed to the care of Mr. Richard Taylor, Red Lion Court, Fleet Street, London. Several eminent zoologists have already formed themselves into a committee; and we have reason to believe that it is their intention to submit their plan to the next meeting of the Association at Manchester. They deserve the co-operation of all zoologists, and the encouragement of all men of science.

STURZ, HELFRICH PETER, born February 16th, 1740, at Darmstadt, was, although in a subordinate class of literature, a first-rate writer, and almost the first who distinguished himself by an elegant and graceful prose style in German, and by his playful humour. After filling the post of private secretary, first to Baron von Widmann at Munich, and next to the chancellor Von Eyben at Glückstadt, he went, in 1762, to Copenhagen, where he resided some time in a similar capacity with the minister Bernstorf, who obtained for him appointments of very considerable value. In 1768 he was made Danish 'Legationsrath,' and visited France and England in the suite of Christian VII. From this journey originated his 'Briefe eines Reisenden,' which contain many interesting details, and various anecdotes relative to the eminent literary characters and others to whom he had been introduced. At this period, while enjoying the present, he could look forward to still brighter prospects for the future; but the scene suddenly changed. Implicated in Struensee's fall, he was arrested in January, 1772, just as he was on the eve of being married, and although released within about four months, so great was the shock he experienced, that he never completely recovered from it, for it continued more or less to affect both his mind and his body during the rest of his life. His circumstances too were greatly changed by that event; and although he obtained an appointment which afforded him a sufficiency, it was in a small town in the duchy of Oldenburg, where he was completely removed from that polished and intellectual society which he had enjoyed in the capital. He had pined in this sort of banishment several years, when letters reached him from Copenhagen announcing the most flattering prospects, but such was the effect the unexpected intelligence had upon him, that he survived it only two or three days, being suddenly carried off by fever 12th November, 1779.

Besides the work above mentioned, and his 'Reminiscences of Bernstorf,' he wrote a number of literary papers on miscellaneous subjects, which he had begun to collect and publish just before his death.

STUTTGARD, the capital of the kingdom of Würtem-

berg, and the residence of the king, is situated almost in the centre of the kingdom, in 48° 45′ N. lat. and 9° 12′ E. long., 759 Paris feet above the level of the sea. It lies at the bottom of a valley, surrounded on three sides by mountains and hills, which are covered with vineyards and gardens. The valley is extremely fertile, and forms what the Germans call an English garden, extending to Kannstadt. The city consists of the old town, the suburb of Essling, the upper (or rich) suburb, and the new streets and suburbs built under the late King Frederick. These however have been all thrown into one, every mark of separation between them being removed. The old part of the city is ill built, the streets being narrow and irregular, and the houses, for the most part, of wood. The more modern parts have straight streets, intersecting each other at right angles, and contain many handsome buildings. The new royal palace, in particular, is a noble edifice, consisting of a centre and two wings; it has an extensive park, and in front of it is the spacious parade. The gardens and grounds of the palace are very fine, and extend to the new royal country-seat of Rosenstein, near Kannstadt. The palace contains a good collection of paintings and statues, and the windows command delightful views over the adjacent country. In the vicinity of the palace there are several public institutions. Among other buildings deserving notice (of which Stuttgard has, in proportion to its size, a great number) are, the Gymnasium Illustre, the building formerly the military academy, which resembles a palace, the old palace, the opera-house (one of the largest in Germany), the hotel of the department of foreign affairs (formerly the palace of the crown-prince), the royal mews, the palace of the estates of the kingdom, the archives, the new hospital, the three principal Protestant churches, the Roman Catholic chapel, the French Protestant church, and the three barracks, which are among the most considerable buildings in the city. There are numerous public and private collections of works of art, and several libraries; the public royal library contains 200,000 volumes, among which is a unique collection of 12,000 bibles, of 4000 different editions, in 68 languages. The king's private library of 30,000 volumes contains valuable old works and manuscripts, and a great variety of splendid modern publications. Stuttgard has a gymnasium, an academy of arts, a school of arts, a botanic garden, a veterinary school, a topographic-statistical society, a savings'-bank, a Bible society, and numerous schools, and other useful establishments for the poor, and charitable institutions of all kinds. The institution called Katharinenstift is a school for girls, founded by the grand-duchess of Oldenburg, sister of the emperor of Russia, who was in England with the emperor Alexander, and afterwards married the king of Würtemberg. She died in 1819. The population of Stuttgard is 35,000, with the garrison and strangers. There are manufactories of linen and woollen cloths, silk, cotton, gloves, carpets, shawls, &c., and the place is noted for its beautiful works in gold, silver, and bronze; excellent mathematical, philosophical, optical, and musical instruments; cabinet furniture, lackered ware, and carriages. The bark-trade is extremely flourishing.

The history of the city does not carry us back into remote antiquity. The name of Stuttgard first occurs in 1229. It appears however that it was a fortified town in 1286, when it was besieged for seven weeks by the emperor Rudolph I. In 1320 the sovereigns (then counts) of Würtemberg fixed their residence here, and since 1482 it has been the capital of all the possessions of the house of Würtemberg. Near Stuttgard is the beautiful royal country-seat 'The Solitude,' situated on a mountain.

(A. Fischer, *Das Königreich Würtemberg*, 1 vol., Stuttgard, 1838; J. D. G. Memminger, *Beschreibung von Würtemberg*; Hassel; Stein; Hörschelmann; Cannabich, &c.)

STYLA'RIA, Lamarck's name for *Nais proboscidea*, one of the Abranchous Setigerous Annelids of Cuvier.

STYLE. (Botany.) [STIGMA.]

STYLE, used for manner of writing, from the Latin *stylus*, the same word with the Greek στύλος, a 'pillar' or 'column:' στύλος probably contains the same element with ἵ-στη-μι, 'to place' or 'make erect,' and with the verb στύομαι. The Romans gave that name to an iron bodkin having a sharp point, with which they were accustomed to write by exaration, or scratching, on their wax-covered tablets or note-books; and from the instrument of writing, the term was transferred to the writing itself, and that too considered in reference not to the form of the characters (which would have been the more immediate transition), but to the mode of expression. Among the Romans however the term, in this figurative application of it, retained always considerably more of its antecedent meaning than it does with us. We say not only style of writing and style of speaking, but style of painting, style of architecture, style of dancing, style of dress, style of anything in which form or manner is conceived to be, in however slight a degree, expressive of taste or sentiment—if even this much of distinction still remains between what is called style and mere manner in the widest or loosest sense.

Style, in writing or speaking, may of course mean a bad style as well as a good style. Yet when the word stands alone, we always understand it in the latter sense—just as when we speak of expression in painting or in music we mean just or forcible expression. Thus Swift has said, 'Proper words in proper places make the true definition of a style.' This however is merely to tell us, what is sufficiently obvious, that the art of expressing thought by language consists in two things: first, the selection of words; second, their collocation or arrangement. That to constitute a good style, both this selection and this collocation must be proper, there can be no doubt; the only question is, what constitutes propriety as to such matters. Style has been sometimes considered as nothing more than the image or outward expression of thought, as its produce or creation in the same sense in which it may be said that the impression upon the wax is the creation of the seal; and it has hence been assumed that all that is necessary for the ensuring of a style of any degree of excellence is the possession of a corresponding power of thought. But a little reflection will satisfy us that this is an insufficient explanation. Of two men equal in powers of mind, and equally in possession of a subject, nothing is more common than that the one should be able to expound it much more clearly and effectively than the other. Language is an instrument the use of which must be learned like that of any other instrument. As a man may have a high capacity for music, and may have a perfect idea of a tune in his head, or may even be able to sing it, without being able to play it or any other on the violin, so a man may have the intellectual powers which fit him for excelling in oratory or poetry, without having the knowledge or command of language necessary to give them adequate effect. Style is rather the vehicle than the mere expression of thought; and the thought may be present where the vehicle is wanting. To some extent also it may be said to be the dress of thought, or that which ornaments and sets off thought, not only by the added charms of sound, but by other powers which are inherent in words, and of which unexpressed thought knows nothing. As there are 'thoughts that breathe,' so there are 'words that burn'—that by their associations excite impressions of the grand, the pathetic, or the humorous, whether they are addressed to the ear or merely to the eye. And great effects are also to be achieved by the arrangement of words, not only in the production of melody and cadence, but in a higher kind of gratification or excitement—as by the luminous disposition of all the parts of the sentence, by the presentment of every term at the place best fitted to bring out its whole import, by all the resources of what the grammarians call inversion, ellipsis, and other figures of speech; which indeed, wherever they are properly used, are no deviations from natural syntax at all, but, on the contrary, the most natural forms that can be employed. For, while writing is an art, it is nevertheless most true that, like all the other arts the purpose of which is to give expression to mind, the guiding and controlling principle of its exercise, its life and being, as we may say, must ever be as exact and sympathetic a conformity as possible to the thoughts or emotions of the writer. Whatever more style is than the mere expression of thought, that much it must be at the least. A powerful thinker may not always be a powerful writer, but no man can be a powerful writer who is not a powerful thinker. Even the humblest quality of style, mere perspicuity, cannot be attained without a corresponding degree of clearness of thought. We sometimes meet with a perspicuity which is little more than grammatical, and hardly belongs to style at all; but even that implies distinct conceptions so far as they go—a limpid stream of thought, however little depth or spaciousness of intellect. And as for all higher attributes, it is manifest that they cannot be found in the style, if they do not exist in the mind of the writer. The only fountains

from which a man's words can derive the animation of true passion, or poetry, or wit, must be his own head and heart.

The lowest kind of writing that deserves the name of a style at all (unless it is to be called a bad style) ought, as we have observed, to be perfectly perspicuous, that is to say, readily and completely intelligible in so far as the understanding of it depends merely upon a knowledge of the language. The subject may be a difficult one, but that is only a reason for more pains being bestowed to make the style clear and easy, by a lucid arrangement and the avoidance of all ambiguities of expression. But although this rule may be justly insisted upon where nothing beyond such perspicuity is desirable, it will not bear to be so rigidly enforced in regard to the higher kinds of style. Here some sacrifice even of perspicuity is at times to be submitted to, for the sake of appropriate effects which could not be otherwise attained. Æschylus, no doubt, might have made his choruses, Pindar his odes, Tacitus his historic pictures, more easily comprehensible, better fitted for the use of such readers as would always run while they read, by greater diffuseness and dilution of style; but much more certainly would have been lost than gained by the attempt. Facility of being understood is a valuable quality in a style which has no other attractions; but it has been greatly overrated by the rapturous way in which the grammarians have been accustomed to speak of it. What is to be desired in the highest kinds of writing, as in the highest creations of all the fine arts, is not perfect comprehensibility at a glance, but rather that fulness and profundity of meaning which can never be wholly comprehended, but supplies inexhaustibly something new to be seen and felt every time we return to the work.

In every cultivated language however, the progress of style is decidedly towards more and more of first-sight intelligibility, in so far as that depends upon precision of phrase, and the use of words in certain limited meanings. This has been remarkably the history of the English language, at least for the last two hundred or two hundred and fifty years, during which we have been fixing both our grammatical forms and our rules of syntax to an extent that would surprise most persons if the evidences of it were stated in detail. Whether all that has been done in this way has really improved the language,—whether it has been thereby rendered more expressive, more flexible, more fitted for the various ends which a language ought to subserve, may perhaps be questioned. The gain in point of precision may possibly be more than balanced by the loss both in ease and in variety of style. We will instance one of the modern regulations about which the grammarians are wont to make a very great cry, the asserted necessity of always taking care that the reference of the personal or relative pronoun should be to the last-mentioned substantive of the same gender and number. Now, in the first place, this rule never is nor has been observed in the practice of any writer as it is laid down in the grammars: the reference of the pronoun is always not to the most proximate, but to the most prominent, of the antecedent substantives—to the one which the course of the sentence or statement has placed uppermost in the reader's mind; that is the actual, as it is the natural reference, and it would be absurd that the pronoun should be used upon any narrower principle. But in former times even that principle was by no means rigidly adhered to. If we turn, for example, to the 'Fairy Queen,' we find Spenser, certainly one of the greatest masters of language that ever wrote, and who has applied all the resources of his own English at once with the most consummate skill and the most wonderful effect, making his *hes*, and *shes*, and *its*, in every stanza, perform all sorts of services, and refer to almost any preceding substantive he pleases, wherever they may be placed. Nor is this licentiousness attended with any practical inconvenience. It may be a little offensive at first to our unaccustomed eyes or ears, but this soon wears off; the meaning of the passage is usually as obvious as if the modern rule were ever so carefully attended to, while the advantage which the disregard of it gives in point of spirit and freedom to the composition is far from inconsiderable.

In another respect however English prose eloquence has undergone a change of character in an opposite direction, by the greater infusion which it has received of a colloquial tone and phraseology within the last century and a half. Till towards the close of the seventeenth century the language of books, except in the comic drama and other light compositions of a kindred character, generally preserved a formality of gait and manner which distinguished it nearly as much from living conversation as the critics have held that the language of verse should be distinguished from that of prose. Among the most eminent of the writers who first broke through this species of restraint were Cowley, in his Essays; Dryden, in his prefaces and other prose discourses; Sir William Temple, and the third earl of Shaftesbury. The example set by them was followed by Swift, Addison, Steele, and their associates and imitators, till in the earlier part of the last century the colloquial ease and liveliness, which had thus become fashionable, threatened to degenerate into a slovenliness, or shambling fluency, alike without either elegance or precision. It must be admitted, that of all the writers of the second quarter of the eighteenth century, Lord Bolingbroke, whatever opinion may be entertained of his depth of thought or weight of matter, wrote the best style, at once the most flexible and idiomatic, and the purest, most refined, and most musical. But probably the writer who on the whole did most to restore measure and emphasis to our prose style was Johnson: his manner has not been much copied in all his peculiarities or in its entire character, but yet more or less of its influence may be detected in the style of nearly every one of the more remarkable writers who have subsequently appeared among us, including even such diversities as the sonorous inanity of Macpherson's 'Ossian,' the epigrammatic point and terseness of Junius, and the brilliant falsetto of Gibbon. At the same time however examples of altogether a different character were also producing their effects; and the rude vigour of Warburton, the naïveté of Sterne and Goldsmith, and, above all, the rapidity, variety, and imaginative splendour of Burke, have all operated powerfully in forming the greatest of our later writers. Finally, with all these influences have mingled and co-operated two others which have also been impulsive and generative to a considerable, though not both to the same extent:—on the one hand, the revived study of our old Elizabethan literature; on the other, the new life and spirit that has been put into literature, as into all things else, by the political and social convulsions of the last fifty years. These two influences, though thus apparently opposite in origin, have proved rather mutually assistant than contradictory.

Purity of style is more intimately connected with many apparently higher things than is commonly supposed. Remarking on 'the power and value of words, and the duty as well as advantage of using them appropriately,' Coleridge says (in a note to his work 'On the Constitution of the Church and State,' 1830, p. 19), 'Many years ago, in conversing with a friend, I expressed my belief that in no instance had the false use of a word become current without some practical ill consequence, of far greater moment than would, *primo aspectu*, have been thought possible. That friend, very lately referring to this remark, assured me that not a month had passed since then without some instance in proof of its truth having occurred in his own experience; and added, with a smile, that he had more than once amused himself with the thought of a verbarian attorney-general, authorised to bring informations ex-officio against the writer or editor of any work in extensive circulation, who, after due notice issued, should persevere in misusing a word.' When it is considered indeed what the wrong use of a word in most cases springs from and implies, the mischief it is apt to occasion is easily understood. It is produced by a confusion of thought, which is propagated wherever the vicious mode of expression prevails, and which, besides the injury done in the particular case, helps generally to impair the habit and the faculty of clear and correct thinking. Yet words, for obvious reasons, have a strong tendency to shift their signification; if a language were to be merely spoken, and not written, this would be constantly taking place to a very great extent; the only thing that can check it, that can furnish a practically available standard of the language, is the employment of it in writing. Originally indeed the principles upon which it is written must be taken from its spoken form—from the *usus et norma loquendi*; but afterwards commonly the spoken language both will be and ought to be rather regulated and controlled by the written language. If it should continue to be otherwise, the language would not improve, but would degenerate towards barbarism; for there could be no progress in any other direction, in this or in anything else, where

the comparative slovenliness and incorrectness of extemporaneous precipitation were allowed to carry it over the best efforts of deliberation and care. There is always danger however of something of this happening wherever extemporaneous oratory is much in demand; and where the practice of public speech-making prevails to a great extent among the imperfectly educated classes, the case is of course so much the worse. There is reason to fear that such an influence is acting, along with other causes [AMERICANISMS], to seduce the more ambitious writers of English America into an inflated, big-worded, loud sounding style, which is about as offensive to good taste as the noisy exaggerated eloquence of a person half drunk always is to a sober man. The speechifying or preaching style seems to threaten to become the only style even for written composition in the United States, and its standard the violent vociferation and empty rumble of the newspapers.

STYLE, OLD AND NEW. By the Old Style is meant the mode of reckoning time anterior to the Gregorian reformation of the calendar; and by the New Style, that adopted since. The adoption of the reformation at different times by different countries, renders it necessary to remember the difference of their reckonings, as follows.

The reformation took place in 1582; from thence to the end of February, 1700, new style is *ten* days in advance of old style: thus January 1 (O. S.) is January 11 (N. S.), and so on.

From and after March 1, 1700, to the end of February, 1800, new style is eleven days in advance of old style: thus January 1 (O. S.) is January 12 (N. S.).

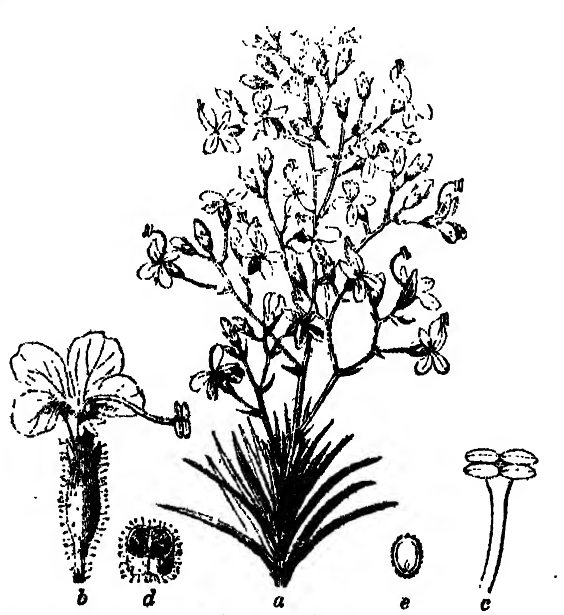
The new style was adopted in England by 24 Geo. II. (1751), which enacted, 1, That the year 1752 should begin on the 1st of January instead of the 25th of March, which was then the *legal* commencement. 2, That the 3rd day of September, 1752, should be called the 14th, or that the days from the 3rd to the 13th inclusive should have no nominal existence. Accordingly, the year 1751 had no January, February, nor March up to the 24th inclusive; and September wanted eleven complete days.

According to Sir Harris Nicolas, the new style was adopted as follows: by Denmark, France, Holland, and most of the Low Countries (some towns excepted), most of Italy, Lorrain, Portugal, and Spain, in 1582; by German and Swiss Catholics in 1584; by Poland in 1586; by Hungary in 1587; by German and Swiss Protestants, and the remaining parts of Holland, &c. in 1700; by Tuscany in 1749 or 1751; and by Sweden in 1753. It is not yet adopted in Russia.

It was at one time sometimes the mode to express the date in both styles. We have an old letter written from France to Holland in 1619, as we should now call it, the date of which is Février $\frac{18}{28}$, 161$\frac{8}{9}$. [PERIODS OF REVOLUTION.]

STYLES OF ARCHITECTURE. All the principal styles have been spoken of under the heads of CIVIL ARCHITECTURE—*Egyptian, Gothic, Hindu, Italian, Lombardic, Mexican, Moorish, Norman, Roman*; and to them may here be added some subordinate styles, which are to be considered rather as peculiar and temporary modes, than distinct, independent, and established styles. Such are those known by the appellations of Burgundian, Flamboyant, Cinque-cento, and Elizabethan. Of these the two first mentioned are peculiar to France; and the *Burgundian* may be considered as corresponding with our own Tudor, since it exhibits, with many points of difference, many also of resemblance, and the same general character as to enrichment, and the adoption of very flattened arches, or else horizontal lintels, for the openings of windows. Château Fontaine le Henri and several other examples of this style may be seen in Pugin's 'Antiquities of Normandy.' *Flamboyant* is a term that has recently been applied to that species of French Gothic whose tracery is entirely composed of flowing curves, forming not a perfectly symmetrical pattern. The name has been bestowed from the fancied resemblance to the waving outline of *flames*. The portals of Abbeville, Beauvais, and St. Maclou at Rouen are fine specimens of this style. *Cinque cento*, otherwise sometimes called the *Renaissance* style, is that which arose on the first attempt to revive and apply the classical orders without any regard to their original character. If Roman architecture departs very widely from the principles of that of Greece, the Cinque-cento departs quite as much, and sometimes still more so, from those of the Roman. It is essentially *microstyle* in composition, the orders being treated as diminutive decorative features, not only intermixed with, but almost overwhelmed by others of very grotesque and incongruous design. Still the style possesses historical interest; and although devoid of beauty, is, in many instances, exceedingly rich and eminently picturesque. It was that which prevailed in France in the time of Francis I., and has lately been much affected and brought into vogue again in that country for purposes of interior decoration. Among others, Heidelberg Castle is a noted and splendid example of this style in Germany. What is called *Elizabethan* may be considered the English Cinque-cento or Renaissance—a style in itself full of barbarisms and extravagances, yet frequently rendered imposing by the magnitude of the structures in which it was displayed, and by that profusion of fantastic ornaments which recommends it to the taste of many even at the present day.

STYLIDIA'CEÆ, a natural order of plants belonging to the epigynous group of monopetalous Exogens. They are herbaceous plants, or under-shrubs, with aqueous juices, sometimes having hairs, which are simple, acute, or capitate; the stem and branches are round, or sometimes they have a scape. The leaves are entire, without stipules, mostly scattered, sometimes whorled, the radical ones clustered in the species which possess a scape. The flowers are solitary, or arranged in spikes, racemes, or corymbs, mostly terminal; the pedicels have three bracts. The tube of the calyx is attached to the ovary; the limb is 2-6-parted, bilabiate, or regular and persistent. The corolla is monopetalous, irregular, 5- or 6-cleft, imbricated in æstivation, and late in falling off. There are two stamens, the filaments of which are united with the style, the whole forming a single elongated column; the anthers are 1- or 2-celled; when the latter, they lie over the stigma; the pollen is globose, simple, sometimes angular. The ovary is 2-celled, or sometimes 1-celled from a contraction of the dissepiment, many-seeded, with a single gland in front, or two opposite ones; the style is one with the filaments, and the stigma, which is simple or bifid, is enclosed and hidden by the anthers. The fruit is a capsule, with two valves and two cells: the seeds are indefinite, small, erect, sometimes stalked; the embryo is minute, and enclosed within a fleshy somewhat oily albumen. This curious order of plants is allied to Campanulaceæ and Goodeniaceæ, but the peculiar union of its filaments and style into a single column distinguishes it at once. This column possesses a considerable degree of irritability. [STYLIDIUM.] There are only two genera of this order known besides Stylidium. They are chiefly found in New Holland, but species have been discovered in



Stylidium laricifolium.

a, cutting showing corymbose flowers and leaves; *b*, flower showing irregular corolla, tubular calyx, and capitate hairs; *c*, filaments and style, forming a single column, with anthers covering stigma; *d*, 2-celled ovary; *e*, section of seed with minute embryo.

the Himalaya, Ceylon, and the South Sea Islands. Their properties are unknown.

STYLI'DIUM (a diminution of *stylus*, 'a column'), the name of a genus of plants, the type of the natural order Stylidiaceæ. The essential characters of this genus are: calyx 2-lipped; corolla irregular, 5-parted, form of the segments equal, the fifth smaller, forming a labellum, which is deflected; column consisting of filaments and style, reflexed, with a double curve; anthers with two lobes widely separated; stigma obtuse, undivided; capsule bilocular, with the dissepiment sometimes superiorly incomplete. This is chiefly a New Holland genus of plants, and is remarkable for its gynandrous structure, and for the irritability of the column formed by the union of filaments and style. Irritability is seen in many genera allied to this, as in the indusium of Goodenia. The part which exhibits movement on being excited is the curved column, and the irritability is confined to a small portion only of the column near its base. In the natural state the column projects from beyond the flower, and hangs down over the smaller petal or labellum, and the irritable part of it is in contact with the labellum. The movement of the column consists in raising itself from this deflected position to that of perfect uprightness. In the bud, the column does not possess this power, but as the anthers develop, this property of the column increases, and is at its greatest intensity at the time of the dehiscence of the anthers, and entirely ceases when the impregnation of the ovules has taken place. During this process the anthers also undergo a change; previous to dehiscence, they entirely cover the stigma, but after this process has taken place, the stigma is fully exposed, and remains so. The irritability is then developed with the anther: it is at its greatest height whilst the anther is performing its function, and ceases with the function of that organ. The movement of the column is produced by external stimulants or the application of a solid body , Exposure to heat will erect the column, and its withdrawal will cause it to return to its natural position. After returning to this state, it requires ten or fifteen minutes' rest before it will again exhibit irritability. When elevated, the column cannot be made to return by force to its bent position. When the movement takes place naturally, it is slow and regular, and when under the influence of artificial excitants, it occurs suddenly and by jerks. The final cause of these movements is evidently connected with impregnation, and it seems that the pollen is conveyed to the stigma whilst the column is upright, which could not be the case whilst it was dependent.

The species of this genus described by Mr. Brown, in his 'Prodromus Floræ Novæ Hollandiæ,' are forty-five in number; besides these there are two or three natives of the East Indies.

STY'LIFER, or STILIFER, Mr. Broderip's name for a new family of PECTINIBRANCHIATA, characterised by him from a shell with the soft parts attached, among other specimens brought home by Mr. Hugh Cuming.

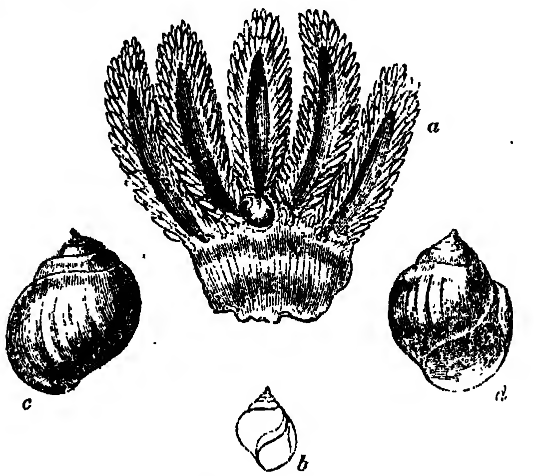
Generic Character.—Shell hyaline, turbinated, the apex of the spire mucronate. The aperture subovate, acuminated above. The external lip acute and sinuated.

Animal.—The mantle thick, fleshy, and cup-shaped, covering the last whorls of the shell. The proboscis very long and retractile. The tentacles round, thick, subacuminate, and situate at the base of the proboscis. Eyes very small, sessile at the base of the tentacles. Stem of the branchia solitary. Animal marine, penetrating into the integument of the star-fish.

Example, *Stylifer Astericola*, Brod.

Mr. Broderip states that the arrival of this species with the soft parts had afforded data for a generic character, indicating a distinct family among the *Pectinibranchiata*, the form of whose mantle differs from any other genus of that order. This mantle, which is of a green hue, is thick, fleshy, and cup-shaped, with a small aperture at its base, and a free posterior margin, enveloping the soft parts and the last volutions of the shell, which has thus somewhat the appearance of a small acorn set in its cup. On the ventral aspect of the mantle is the rudiment of a foot, and from the small basal aperture a retractile proboscis (which, when exserted, is as long as the whole animal) is protruded. At the base of the proboscis are two thick, round, somewhat pointed tentacula; and at the base of them are the eyes, or rather, ocular specks without pedicles. The branchia is placed on a single stem. At the base of the proboscis is a spherical muscular stomach, and the intestine ascends into the spire of the shell, where it becomes attached to the liver, which in *S. Astericola* is of an orange colour.

Mr. Cuming found this elegant parasite burrowed in different parts of the rays of the oral disc of *Asterias solaris*. It was almost hidden from sight, so deeply does the animal penetrate into the substance of the star-fish, in which it makes a comfortable cyst for itself, and wherein it most probably turns by the aid of its rudimentary foot. All the specimens infested with these testaceous mollusks appeared to be in the best health, though there is reason to believe that they feed upon the juices of the star-fish. Mr. Broderip observes that Stylifer (with that instinct of self-preservation which is imparted to all parasites whose existence depends upon that of their nidus) appears, like the larvæ of the ichneumon tribes among insects, to avoid the vital parts; for in no instance did Mr. Cuming find it imbedded anywhere save in the rays, though some of the individuals had penetrated at their base, and very near the disc. When extracted, the older shells have the appearance of a milky-clouded glass bubble: the younger shells Mr. Broderip found of an unclouded transparency.



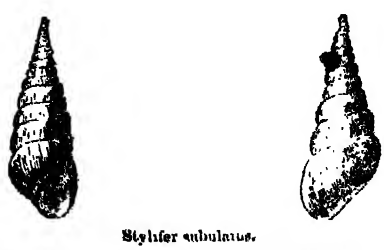
Stylifer Astericola. (Sowerby's *Genera*.)

a, a portion of *Asterias solaris*, showing *S. Astericola* in its cyst; *b*, a specimen of the shell; *c*, *d*, views of the upper and under side of the shell, magnified.

Mr. Broderip remarks that Dr. Turton, in the second volume of the *Zoological Journal*, p. 357, pl. 13, describes and figures a shell under the name of *Phasianella stylifera*, adding that he found a dozen attached to the species of *Echinus esculentus* dredged up in Torbay. Mr. Broderip observes that it is clear that Dr. Turton's shell is not a *Phasianella*, for it is described as having no operculum, and the similarity of the shell leaves no doubt, when joined to the parasitic habits of the animals, that it is one of the congeners of *Stylifer Astericola*. Mr. Broderip therefore names Dr. Turton's specimen *Stylifer Turtoni*.

Stylifer Turtoni.
Natural size and magnified. (*Zool. Journ.*)

Mr. G. B. Sowerby furnished Mr. Broderip with a third species, which, though its habits were unknown to the latter, he considers to be referrible to this genus, and he



Stylifer subulatus.
Natural size and magnified. (Sowerby's *Genera*.)

names it *Stylifer subulatus*; it is so beautifully transparent, that in fine specimens the columella can be as distinctly seen as if there were no intervening medium; and its long apex, which consists of many close-set whorls, is generally out of the perpendicular. (Broderip, in Sowerby's *Genera of Recent and Fossil Shells*, No. xxxviii.)

The characters of the species described by Mr. Broderip will be found in the *Proceedings of the Zoological Society of London* for 1832; and in Th. Müller's *Synopsis Testaceorum*, Berlin, 1836.

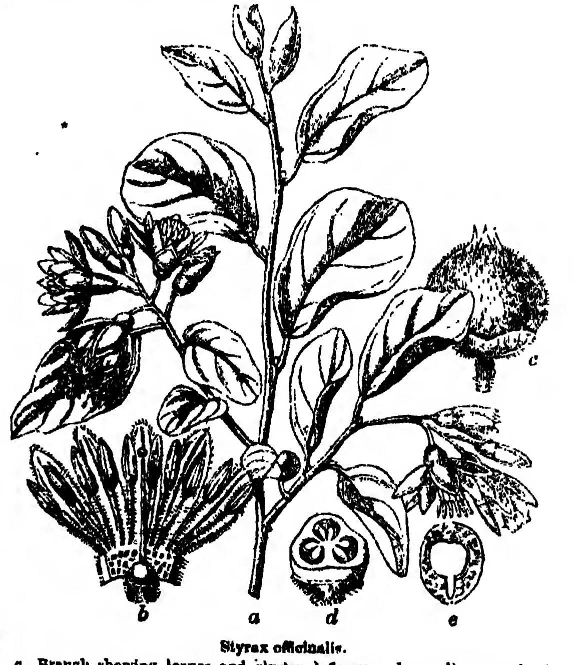
STYLOBATE. In its general meaning this term signifies any sort of basement upon which columns are placed to raise them above the level of the ground or floor; but in its technical meaning it is applied only to a continuous unbroken pedestal, upon which an entire range of columns stand—in contradistinction from *pedestals*, which are merely detached fragments of a stylobate placed beneath each column. So far were the Greeks from considering the stylobate an integral part of an order, that they very rarely employed it, but placed their columns immediately upon the floor of the elevated platform of the gradini, or deep steps, which served as the basement of the temple, and which were generally continued on every side. It was only in particular cases, such as where steps were confined to one end or the front of a building, that, whether columns were continued along its flanks or not, there was of necessity a basement added to those side elevations, equal in height to the ascent of the steps, or the difference of level between the ground and the pavement of the portico: which basement was treated as a distinct pedestal to the whole building. The height of such pedestal therefore varied according to circumstances, and was not strictly regulated by that of the order. Generally indeed it was low in proportion to it, but in the caryatic portico of the Erechtheium at Athens (copied at St. Pancras church, London) we have an example of a very lofty stylobate, its height being nearly equal to that of the figures themselves or the columns of that anthropostyle order. The Romans, on the contrary, broke up their stylobates into distinct blocks or pedestals placed beneath each column; and most followers of that or the Italian school have considered pedestals of that kind to be almost essential to an entire order, and have laid down proportions accordingly, which are in themselves exceedingly faulty, being much too high. At the best, columns upon detached pedestals always look as if placed upon stilts, and where such pedestals are as high as they are sometimes made—one-third, or even more, of the column itself—the columns seem to stand very insecurely, and the effect is very much like that of a round column immediately placed upon a dwarf square one. Another evil resulting from such practice is that the order itself, or columns and entablature, loses much of the importance, and the entablature ceases to be in proportion to the united heights of the column and additional shaft or subcolumn beneath it and in continuation of it. Unless absolutely indispensable, or where there must be some balustrading or parapet between columns, for the sake of security, and then they should be no higher than what convenience requires, pedestals should be avoided altogether. A stylobate, on the contrary, may be so employed as to give additional dignity to an edifice, without detracting from or interfering with the order itself, since it gives the whole structure an appearance of solidity in its lower part. The portico of the National Gallery owes much of its effect to the circumstance of its being elevated upon a solid unbroken stylobate, which is however too plain in itself to accord with the order, and even looks poor and unfinished, from the want of a suitable socle and base mouldings.

STYLO'CERUS. [DEER, vol. viii., p. 362.]

STYPTICS (from στυπτικός, 'astringent'), agents which check the flow, generally of blood, from a relaxed or ruptured vessel. They are a kind of astringent, and the principle of their mode of action has been already detailed. [ASTRINGENTS.] The only point requiring notice here is to enforce the necessity of their prompt employment, as the natural disposition of the blood to coagulate becomes less and less as it continues to flow, till fainting be induced, and a cessation of the current results, after much injury is done to the system. The bleeding may be spontaneous, as is frequently the case with young persons, from whose nose blood frequently flows, even when perfectly quiet, but still more frequently when running or lifting some heavy weight, or it may be the consequence of a wound, such as a leech-bite, or of the extraction of a tooth, or caused by some cutting instrument. Those astringents are alone entitled to be called styptics which can be applied directly to the bleeding orifice; and of these some act chemically, others vitally, and others merely mechanically. Of chemical styptics, a saturated solution of alum, or sulphate of zinc, or creasote, are the best. Strong acetic acid acts both chemically and vitally. When blood continues to ooze from the socket of a tooth, it is a useful plan to plug it with a sponge-tent, which, as it expands, quite fills up the socket, and restrains the hæmorrhage.

STYRA'CEÆ, a small natural order of plants, placed by Lindley in his polycarpous group of monopetalous Exogens. The species are trees or shrubs, with alternate leaves without stipules, usually turning yellow in drying. The flowers are axillary, and are either solitary or clustered with membranaceous bracts. The calyx is persistent, and has five divisions; corolla with divisions, frequently differing from the calyx, and with imbricated æstivation; stamens varying in number, arising from the tube of the corolla, with 2-celled anthers; ovary 3-5-celled, with few ovules, a simple style, and capitate stigma; fruit a drupe; seeds solitary, with the embryo lying in the midst of albumen. This order is nearly allied to Ericaceæ, from which it differs in habit, its definite seeds, and its frequently inferior ovary. It differs from Ebenaceæ in its stamens being perigynous, in the insertion of the ovules, and its simple style. It is however an order on which there are many different opinions, some referring all its genera to Ebenaceæ, whilst others separate from it the genera Symplocos and Halesia as types of distinct orders.

The species are found in the temperate and tropical parts of North and South America, and also in Nepaul and China. This order is chiefly remarkable, in an economical point of view, for furnishing the Storax and Benzoin of commerce, which contain a peculiar acid called the benzoic. Some of the species are used for dyeing yellow, and a species of Alstonia is employed as a substitute for tea. The various species of Halesia are the snow-drop trees of Carolina.



Styrax officinalis.

a, Branch showing leaves and clustered flowers; *b*, corolla opened with perigynous stamens and pistil; *c*, fruit covered with tomentum; *d*, transverse section of ovary, showing 3 cells; *e*, section of seed, showing embryo in the midst of albumen.

STYRAX (from στύραξ), the name of a genus of plants forming the type of the natural order Styraceæ. It has a persistent campanulate 5-toothed calyx; monopetalous deeply 3-7-cleft corolla; 10 stamens monadelphous at the base, with linear 2-celled anthers; superior ovary with indefinite ovules, with simple style and 3-lobed stigma; fruit a dry drupe; seed with a double testa, inverted embryo, and fleshy albumen. The species are elegant trees and shrubs, mostly covered with hairs having a stellate form, with entire leaves and white or cream-coloured racemose flowers. They are principally natives of America and Asia; one is found in Europe and one in Africa.

Styrax officinalis, official Storax: leaves ovate, downy beneath, shining above; racemes 5-6-flowered, simple, shorter than the leaves. It is a native of Syria, Italy, and most parts of the Levant. It is common all over Greece and the Peloponnesus, where Dr. Sibthorp found it retaining almost the same designation as that given it by Theophrastus and Dioscorides, the modern name being *στουρακι*. It was first cultivated in England by Gerarde, but is still a rare plant in this country. One of the finest specimens is in the Botanic Garden at Chelsea, and is annually covered in May and June with a profusion of rich blossoms. This is the species which yields the Storax which is admitted into the Materia Medica of the London Pharmacopœia. [STYRAX.] There is however another Storax known in commerce, with which this must not be confounded, and which is the produce of the *Liquidambar styraciflua*, a plant belonging to the natural order Balsamaceæ.

S. Benzoin, Benjamin Storax, or Gum-benjamin tree: leaves ovate-oblong, pointed, glabrous above, downy beneath; racemes compound, almost the length of the leaves. It is a native of Sumatra and Java. It is the plant which produces the gum Benzoin or Benjamin of commerce, and which, as well as Storax, is used in medicine. [BENZOIN.] The great consumption however of these resins is not as medicines, but in their use as incense in the worship of the Roman Catholics and Mohammedans. Though older botanists, as Garcias, Grim, and others, were acquainted with the tree that yielded Benzoin, Ray confounded it with the genus Laurus, and Linnæus with the genera Croton and Terminalia. Dryander gave a correct account of the plant in 1787, and referred it to its present position.

S. grandifolius, large-leaved Styrax: leaves broad, obovate, pointed, slightly serrated, green above, downy beneath; lower peduncles 1-flowered, solitary, axillary. A native of North America, in woods and on the banks of rivers from Virginia to Georgia. It is a handsome shrub, bearing white flowers, opening them in June and August.

S. lævigatus and *S. pulverulentus* are North American species, and are natives of the woods of the Carolinas and Virginia.

Several other species are described from South America, mostly from Brazil.

The hardy species of Styrax are well adapted for shrubberies, on account of their foliage and handsome flowers. They may be propagated by seeds sown in pots of light soil, and exposed to warmth, but the best mode is by layers, which should be put down in autumn or spring.

STYRAX OFFICINA'LIS is the source of the officinal storax, though an article is occasionally vended under this name, which is obtained from the Liquidamber styraciflua, and perhaps other species of Liquidamber. Of genuine storax there are several varieties, and of those known to the ancients many are now altogether unascertainable, while of those mentioned by even recent writers several are very rare, and only objects of curiosity, not of commercial importance. The tree grows in Greece and Asia Minor, and is cultivated in the south of France, in which last no resin exudes, except occasionally, after very warm summers. Asiatic Turkey supplies whatever is met with in commerce. It is procured by incisions in the bark, or perhaps from the punctures of insects. What flows from these openings is a liquid resinous substance, which concretes into small tears, about the size of peas; these, aggregated into masses, constitute the *styrax albus*, which is of extreme rarity. Another form is that called *amygdaloides*, also of great rarity and extravagant price. It is sometimes termed *calamita vera*. The commercial article is of various degrees of purity and excellence. One kind is called *storax calamita vulgaris*, or *Scobs storacina*. This always contains more or less sawdust, mixed with variable quantities of resin. It is generally in large round cakes, of a brown colour, verging to red or black, with fragrant odour, brittle, and friable, but softens in the mouth, and has a bitter taste. It burns with a light flame. It is considered to be an artificial compound, prepared chiefly in Venice and Trieste. According to the analysis of Reinsch, it contains—volatile oil, a trace only; resin, from 32 to 53 per cent. in different specimens; benzoic acid, from 1 to 2 per cent.; gum, 7 to 14; woody fibre, 20 to 27; ammonia, an inappreciable quantity.

Storax is stimulating in a degree dependent on its purity. For medical purposes it is directed to be purified by solution in alcohol, straining, and afterwards distilling off the spirit. The residuum is then used in a few preparations, such as tinctures and pills. It formerly entered into a multitude of compounds, but it has been greatly discarded, from the extensive adulterations practised with it, and it might be altogether supplanted by benzoin. It is much used to form pastilles, and for fumigations. The bark is called *cortex Thymiamatis*, or *cortex thuris*, from which, by boiling, *liquid storax* is procured, as well as from the liquidamber. There is a storax from Bogota, but its source is unknown.

STYRIA, THE DUCHY OF, in Austria, is situated between 45° 54′ and 47° 50′ N. lat., and between 13° 30′ and 16° 25′ E. long. It is bounded on the north and northwest by the archduchy of Austria, on the west by Illyria, on the south by Illyria and Croatia, and on the east by Croatia and Hungary. The area is about 8500 square miles, or about one-fourth of that of Scotland, and the population amounts to 950,000 souls. The northern and western part of the country is covered with high mountains, which are called by the general name of the Styrian Alps. Properly speaking, they are two great branches of the Julian Alps, which extend to the east; one of these branches separates the valley of the Ens from that of the Mur, runs south-east, as far as the Wild Alps, to the west of Semmering, where it joins the Noric Alps, and then proceeding in a south-easterly direction forms the boundary towards Austria below the Ens, extends into Hungary, and gradually declines to the plain of Oedenburg. The other branch divides the valley of the Mur from that of the Drave, and forms the frontier between Styria and Carinthia. To the south of the Mur the Bacher chain is the continuation of this branch. A third mountain-chain runs from Loibl to the Save, and forms on that side the boundary towards Carinthia. None of the mountains rise to the line of perpetual snow; on the north-western frontier there are some glaciers, but still below the absolute snow-line. The highest mountains that have been measured are the Grössenberg, 8381 feet; the Eisenhut, 7676 feet; the Grimming, 7540 feet; the Stangalpe, 7140; the Hochschwab, 7154; and the Bachstein, 7008 feet, above the level of the sea. The southern and eastern part of the province contains few lofty mountains, but there are many of moderate elevation, and numerous gentle eminences, some of which are separated by extensive valleys. In conformity with the physical character of the country, it is divided into Upper Styria, which comprises the smaller north-western portion, which is entirely mountainous, and Lower Styria, which is the south-eastern, and larger, lower, and level portion. 'Styria,' says Blumenbach, 'is properly a mountainous country, but with the richest diversity; a wild, romantic, beautiful region, which surpasses the magnificence and variety of the finest English park. Throughout the whole country there is an alternation of lofty peaked rocks and perpendicular walls, flowery meadows, lovely valleys, dark impenetrable forests, rushing waterfalls, peaceful lakes, castles, and villages.' The country has numerous rivers, all of which flow into the Danube, and for the most part by an east course. The principal rivers are, 1st, the Mur, which rises in a lake, traverses the centre of the country for about 180 miles, is joined by many smaller rivers, and enters Hungary at Maut; 2nd, the Drave, which enters Styria below Hohenmauthen, and enters Croatia at Fridau; 3rd, the Ens; 4th, the Raab. The Save only touches the southern frontier, towards the government of Laibach, but is joined by the Sän and the Sotla, the latter of which bounds for some extent the south-eastern frontier towards Croatia. The Mur, Drave, Ens, and Save are navigable by boats. There are no large lakes, but many small ones. The largest are, the Grundelsee, above 718 Austrian acres in extent, in many places 60 fathoms deep, and 2031 Paris feet above the level of the sea; the Altenausseersee, 358 acres in extent, and 2280 Paris feet above the level of the sea. The country abounds in cold, warm, and hot mineral-springs, the best known and most celebrated of which are the chalybeate waters of Rohitsch, the sulphureous and alkaline springs of Neuhaus, the alkaline waters of Sekau, and some others.

Like all countries that abound in limestone mountains, Styria has numerous caverns, the most interesting of which is the Mirnitz cavern.

Soil and Climate.—The air in the mountainous part is bleak, though pure; in the valleys of Lower Styria the temperature is much milder, and the vine and maize flourish. The fertility of the soil is various. A great part of Upper Styria consists of bare naked limestone rocks and sterile mountains, but Lower Styria has many very fertile tracts.

Natural Productions.—These are, the common domestic animals, with game, poultry, fish, and bees. The breeding of cattle is very general. The animals are well-shaped, but small, and, as usual in the Alps, are driven in summer to the highest parts of the mountains, and brought back to the plains in autumn. Sheep are not numerous, and the horses are more fit for draught than for the saddle. The vegetable products are very diversified: wheat, rye, barley, and oats, though not abundant in Upper Styria, are of remarkably fine quality. In Lower Styria there are likewise maize, millet, and buckwheat, pulse of various kinds, and culinary vegetables; potatoes, the culture of which was introduced about the middle of last century, are now very extensively cultivated. Of oleaginous plants there are the poppy, sunflower, and rape-seed. Very little hemp is grown; some flax is raised, but not sufficient for home consumption. Of late years hops have been cultivated with success. Wine and fruit are among the chief productions. Timber is a very important article. The principal kinds of timber are the oak and the beech in Lower Styria; the pine, fir, chesnut, walnut-tree, red yew, stone-pine, lime, white poplar, and willow are scattered over the whole country, but for the most part they grow in forests. The great wealth of Styria however consists in its mines, which are confined to the smaller mountainous portion of the country. The most important minerals are—silver, copper, lead, iron (540,000 cwt. a year), alum, cobalt, sulphur, salt, marble, and coals.

Manufactures and Trade.—The manufactures of the country are chiefly of mineral products, the most important of which is iron. The iron-mines in the Erzberg, in the north of Styria, were well known to the Romans. This mountain does not contain the ore in veins or strata, but presents a solid mass of iron-ore, which has been wrought without interruption for eleven centuries.

Styria does not manufacture the whole of the iron produced; the surplus is exported partly to the archduchy of Austria, where the extensive iron-manufactories are chiefly supplied from Styria, and partly, by way of Vienna and Trieste, to France and England. There are a few manufactories of linen, cotton, woollens, and silk, but none of considerable importance. There is a very brisk trade between Upper and Lower Styria; the latter supplies the former with corn, wine, and tobacco, and receives in return iron, timber, and salt. The exports to other countries are chiefly cattle, steel, iron, copper, and lead, to Austria, Hungary, and European Turkey, scythes (a million), sickles (200,000 in a year), steel and some other iron-wares, to Italy, France, Poland, and Russia. Among the smaller articles of iron, several millions of Jew's-harps are annually exported. The imports are very considerable, consisting chiefly of fine cloths, linens, cottons, silks, and jewellery, from Vienna, and colonial produce from Trieste and Fiume. The transit-trade between Italy and Germany, from Vienna to Trieste, is very important. This trade is greatly facilitated by the good roads, especially that between Vienna and Trieste, from which other great roads branch off to the Tyrol, to Linz, to Ofen in Hungary, and Carlstadt in Croatia. The principal commercial towns are Grätz, Pettau, Leoben, Rackersburg, and Marburg. The government is like that of the other Austrian hereditary states; the emperor has the title of duke of Styria. The parliament, or estates, as they are called, consist of four orders—the higher clergy, the nobility, the deputies from the landholders, and the deputies from the towns.

Religion and Education.—The inhabitants consist of two nations: Germans, who are the majority (above two-thirds), and Wends, who are of Slavonian extraction, and speak their own language. The Germans, who inhabit all Upper Styria, the circle of Grätz, and a small part of that of Marburg, are a tall, handsome, robust, good-tempered, and industrious race. The Wends are weak, thoughtless, dissolute, and bigoted. The great majority of the people are of the Roman Catholic religion, the Lutherans not being above 3000 in number. The establishments for education are, the University, two theological schools in convents, four gymnasia with sixty-eight professors and about 1800 students, and 627 Roman Catholic and 4 Protestant schools. There are, besides, several other schools for special purposes. The hospitals, infirmaries, and other charitable institutions are very numerous.

History.—Pliny and Strabo are the first authors who give any account of this province. The inhabitants were completely uncivilised, and harassed the adjoining provinces, till the reign of Augustus, when the country was subdued by Tiberius, and the eastern part incorporated with the province of Pannonia, and the western with that of Noricum. The country was even then celebrated for its iron, steel, and cattle; subsequently industry flourished in the towns, especially in Celeja (Cilly), Petovium (Pettau), and other places. Christianity penetrated early into this country, and spread so rapidly, that episcopal sees were established at Pettau and Cilly; but the irruption of the northern hordes put an end to the prosperity of the country, which was successively overrun by the West Goths, the Huns, the East Goths, the Heruli, the Lombards, the Franks, and other barbarians. In the sixth century the Slavonians established themselves in Lower Styria, and afterwards, when they had expelled the Avari, in Upper Styria, till they were overpowered by the Germans. Charlemagne, having conquered Styria, divided it among several counts: under his successors the country suffered from the internal discords of its chiefs by the incursions of the Bulgarians, and by the invasion of the Magyars, from whose yoke it was delivered by the victory obtained over them by the emperor Otho the Great, in the year 955. The country was divided afterwards into a number of principalities, of which that called the county of Steyer was successively enlarged to its present extent under rulers who bore the title of margraves, and afterwards of dukes, till it was annexed, at the end of the twelfth century, to Austria, with which it has ever since been united.

Various events checked the prosperity of the country, such as the repeated invasions of the Magyars and the Turks, famine, pestilence, the expulsion of the Jews, and the insurrection of the peasantry. The doctrines of the German reformers had been adopted, about the year 1530, by so great a proportion of the inhabitants, that they were openly preached and taught in the churches and the numerous schools which the Protestants had established. At the diet held at Augsburg in 1547, Baron John Ungnad, at the head of the Styrians, applied to the emperor and empire for the free exercise of religion, which the Protestants did not however obtain till the diets held at Bruck, in 1575 and 1578, when the archduke Charles II., being sorely pressed by the Turks, was obliged to grant it, the greater part of the nobility, half of the citizens, and a considerable number of peasants having already embraced the new doctrines.

The rapid spread of the Reformation had been greatly promoted by the school at Grätz, founded in 1568, while the archduke Charles was absent in Spain, which the estates of the duchy converted, in 1573, into a high school for Protestants, and provided it with professors from foreign countries, eminent for their learning. The archduke Charles had already called in the Jesuits to his aid, in 1570, and he assigned them a residence in 1573; on the 12th of November in the same year, he founded the Catholic high school at Grätz, and, at the instigations of his wife Maria of Bavaria, who was full of zeal for the Romish religion, he took measures to restrict the principles of the Reformation, which his son Ferdinand II. prosecuted with so much energy and rigour, that a hundred years after the first appearance of the Protestant preachers in the country, all Styria was re-annexed, by violence, to the Romish faith. Supported by the garrison of the citadel of Grätz, which was considerably increased for the purpose, Ferdinand revoked his father's grant of the free exercise of their religion, and commanded the estates to dismiss the Protestant clergymen and teachers from all the churches and schools within fourteen days. On the 28th September, 1598, the teachers were strictly commanded to leave the city of Grätz on the same day before sunset, and the hereditary estates within a week, on pain of death, and never to return to them. The Protestant high school was closed; a Romish anti-reformation commission was appointed, which boasted of having burned no fewer than 40,000 volumes of Protestant books; and all Protestant citizens were enjoined either to embrace the Romish religion, or to sell their property, and with the proceeds, after the deduction of one-tenth, likewise to leave the country. Many professors of the doctrines of the Reformation abjured their faith, in order to remain in the land of their fathers; 30,000 others, of the richest and most distinguished families, and among them many of the noblest houses, left their native country; and lastly, others concealed their opinions, and cherished them in silence from generation to generation, for two centuries and a

half, till the toleration edict of Joseph II. allowed them openly to profess their faith.

(Hassel; Stein; *Die Oesterreichischer National Encyclopädie; Conversations Lexicon;* Blumenbach, *Gemälde der Oesterreichischen Monarchie*, &c.)

STYX (Στύξ or Στυγὸς ὕδωρ), a small stream in the north of Arcadia, which is now called Mauronero. According to Herodotus (vi. 74) its source was in the Arcadian town of Nonacris. Vitruvius (viii. 3) states that its water destroyed all brass, iron, and silver vessels which were filled with it.

In the antient mythology the Styx was believed to be the principal river of the lower world, round which it flowed nine times. (Virg., *Æn.*, vi. 439.) It was believed to be an arm of the river Oceanus, which flowed round our earth, and the river Cocytus was thought to be a branch of the Styx. When the gods of the antients took a great oath, they always swore by the water of Styx, and awful punishment awaited him who swore falsely. The divinity of the river Styx was a nymph of the same name, who dwelled at the entrance of the lower world in a spacious grotto supported by silver columns. (Hesiod., *Theog.*, 778.)

SUABIA, one of the ten circles into which Germany was divided previously to 1806, comprehended the south-western part of Germany, one of the most beautiful and fertile tracts of the whole empire, traversed by the Danube from the south-west to the north-east, by the Black Forest on the west, and by the Alps in the interior and on the south. It was situated between France, Bavaria, Switzerland, Franconia, and the circles of the Rhine, and had an area of 13,000 square miles, with 2,200,000 inhabitants. Its chief natural productions are corn, wine, and fruit, and in the mountainous parts minerals, and timber, which is floated down the Neckar and the Rhine to Holland. The country of the Suevi, from whom the name of Suabia is supposed to have been derived, was more extensive than the modern circle. Christianity was introduced at the beginning of the seventh century by the Irish monk Columba. In the year 1080 Henry IV. gave the duchy of Suabia to Count Frederick of Hohenstauffen, the ancestor of the emperors of the house of Suabia. Frederick did not however obtain peaceable possession of the duchy till 1096. Under his distinguished successors, the Suabians were the richest, the most civilised, and the most respected of all the nations of Germany. But when the Italian wars and the contest with the Guelfs had broken the power of the house of Hohenstauffen, and it became extinct on the execution of Conradin in 1268, their vassals, cities, prelates, and counts made themselves independent. Many Suabian cities joined the Rhenish Federation, founded in 1254, and Würtemberg in some measure took the place of the extinct duchy of Suabia. This is not the place to enter into the details of subsequent events, the sufferings of the people from repeated wars, from civil discords and disputes between princes and their subjects, till the final dissolution of the antient constitution of the empire, and the partition of the country among Würtemberg, Bavaria, Baden, the princes of Hohenzollern, the prince of Lichtenstein, Austria, and Hesse-Darmstadt. The largest cities are Augsburg, Stuttgard, and Ulm.

The very name of Suabia has disappeared from the maps and gazetteers of Germany, and was only revived about three years ago by the king of Bavaria, who restored to the circles of the kingdom the antient historical names, and gave that of Suabia to the circle of the Upper Danube.

(*Conversations Lexicon;* Hübner, *Zeitungs Lexicon; Weimar Almanach*, &c.)

SUAKIN or SOUAKIN, a town or seaport in Nubia, on the west shore of the Red Sea, is in 19° 4′ N. lat. and 37° 30′ E. long., at the extremity of a narrow inlet, about twelve miles in length and two in width. The entrance of the bay is only about sixty fathoms wide, but it opens gradually to two miles. With northerly winds it is very difficult to enter or to leave the bay. But when the winds are from the south, there is a regular land-breeze every morning, which obviates all difficulties. The bay has a sufficient depth of water, generally varying between fifteen and nineteen fathoms. At the bottom of the bay there are several islands, on one of which the town is built. The town is separated from its suburb, called El Geyf, which stands on the mainland, by an arm of the sea about five hundred yards wide. The harbour, which is on the east side of the town, is formed by a projecting part of the continent. The arm of the sea on the west side affords no anchorage for ships of any size. The islands and all the surrounding country are sandy, and produce only a few shrubs or low acacias. The houses of the town have one or two stories, and are constructed of blocks of madrepores. They have a neat appearance, but the greater part of them are falling to decay. The suburb El Geyf is rapidly increasing in size and population, and is now larger than the town itself; but there are few houses of stone, the greater part of the dwellings being formed of mats or rushes, like those of the Nubian Bedouins. Suakin has three mosques, and El Geyf one mosque. The water of the wells, which are about half an hour from El Geyf, is tolerable, but in none of them is it good. Burckhardt estimated the population of Suakin at about 8000, of whom 3000 live upon the island and the rest in El Geyf.

Suakin is the most important trading-place on the west shore of the Red Sea. The inhabitants have no other pursuit than commerce either by sea or with the contiguous countries of Eastern Africa. They export the commodities which they receive from Eastern Africa to all the harbours of Hejaz and Yemen, down to Mocha, but chiefly to Jidda and Hodeyda. Many of the merchants go to Sennaar to buy their goods, and, after returning to Suakin, they perform the journey to the Arabian coast, but others sell their African merchandise to the traders of the town, by whom they are exported to Arabia. They bring from Sennaar, Kartoun, and Shendy, slaves, gold, tobacco, incense and ostrich feathers; from Beled-el-Taka, a country situated on the east of the river Atbara, great quantities of dhurra; and they collect in the country to the west of the town larger numbers of water-skins, leathern sacks, and tanned hides, all which articles find a ready sale in the ports of Arabia. The hides are tanned by the Bedouins who live in the neighbouring mountains, and are used in Arabia to make sandals. A large quantity of butter in a liquid state, the only form in which it is used in this country, is likewise exported to Arabia, as well as mats made of doum-leaves, which are partly used to cover the floors of the mosques at Mecca and Medina, and partly bought by the pilgrims for the purpose of kneeling upon when they pray. These two articles are also obtained from the Bedouins in the mountains near Suakin. Horses and dromedaries are brought from the countries on the banks of the Nile, and sent to Hodeyda. At Jidda the Suakin merchants purchase all the Indian goods which are wanted for the African markets and the consumption of their own town, as dresses and ornaments for women, household utensils, and several kinds of provision for the table, such as Indian sugar, coffee, onions, and particularly dates, which are not produced in any part of Eastern Nubia. Much iron is also imported for lances and knives, which are manufactured by common smiths, who are the only artisans at Suakin, except masons and carpenters, and furnish these weapons to all the Bedouins in a circuit of fifteen days' journey. The trade by sea is carried on principally in ships belonging to people of Suakin and Jidda; they are almost entirely occupied in sailing between the two coasts. They are often manned by Bedouins, but more commonly by Somaulys from the African coast between Abyssinia and Cape Guardafui, who are the best sailors in the Red Sea. The number of black slaves annually brought through Suakin to the coast of Arabia amounts, according to Burckhardt, to between 2000 and 3000, and about an equal number are sent there from Massowah in Abyssinia, where about 3500 are annually shipped to Mocha. Many pilgrims, mostly negroes from Beled-el-Sudan, who have been converted to the Mohammedan faith, pass annually through Suakin in going to or returning from the holy cities of Arabia.

The inhabitants of Suakin, like those of all the harbours in the Red Sea, are a motley race, but the majority of them are descendants of natives of Hadramaut, and principally of the town of Shabher, the harbour of that country in the Indian Ocean; they are called Hadherebe. The other inhabitants are called Suakiny, and consist of individuals of the Bedouin tribes of Hodendoa, Amorer, the Bishareen, and others of Arabian and of Turkish origin. The Bisharye language is generally spoken in El Geyf, but the inhabitants of the town speak the Arabic as their native language, and with the Jidda pronunciation. The island contains a public school.

(Lord Valentia's *Voyages and Travels to India, Ceylon, the Red Sea, &c.*; and Burckhardt's *Travels in Nubia.*)

SUA'REZ, FRANCIS, eldest son of Gaspar Suarez of Toledo, and of Antonia Vasquez of Utiel, was born at Granada, where his father practised as an advocate, on the 5th of January, 1548. After receiving a good elementary education, he was sent to Salamanca to study law in 1562. The members of the Society of Jesuits, founded about 20 years before, were at this time labouring to extend the ramifications of their order with the full force of the enthusiasm which gave it birth. John Ramirez, as Suarez asserted in after-life, induced no less than five hundred students of Salamanca to devote themselves to a religious life by the fervour of his preaching on Quadragesima Sunday in 1564. Suarez himself was among the number. He experienced considerable difficulty before he could induce the superiors of the order to admit him to probation; and even after John Suarez, the provincial-general, had resolved to receive him, on account of his possessing qualifications which appeared capable of being turned to account, remonstrances were offered against this determination by more than one member of the Society. During the period of his noviciate Suarez eminently distinguished himself by that obedience and humility, and disregard of self, which it was one of the great objects of the founders of the order to impress upon their disciples; at the same time that something about the young man showed this submission to be the consequence not of a weak or timid disposition, but of a powerful spirit of enthusiasm enforcing self-abasement. Before the probationary two years were completed, he was made to begin his philosophical studies. Pursuits so new and so alien to his impassioned temper at first excited in him nothing but sentiments of weariness and disgust; he made little progress, and earnestly begged of his superiors to allow him to desist from studies for which he was convinced he had no capacity. A more favourable opinion of his talents continued notwithstanding to gain ground among the order, and Martin Guttierez, then in high estimation among his brethren, was wont to say, pointing to Suarez, 'God intends, through the instrumentality of that brother, to magnify the church, and do honour to the Society.' Deferring in this, as in everything, to the directions of his superiors, Suarez toiled through the usual course of philosophical study, but apparently with indifferent success; for when advanced to the theological classes, in which he took more pleasure, he found his progress obstructed by his deficiency in the preparatory branches of instruction. With the powerful impassioned will which enabled him to wrest, as it were, by his pertinacity, from the reluctant fraternity admission into their Society, he now laboured to make up his deficiencies. With this view he compiled for himself a system of metaphysics, the same which, published at a later period, with a very few finishing touches, elicited much applause. Having completed this task, he devoted the whole of his private hours to self-tuition in the science of casuistry. Having taken his vows at the usual time, Suarez was immediately employed in the educational department. He taught philosophy for a short time at Segovia, and next theology, for several years, at Valladólid. In 1580 he was called to Rome, and lectured on theology there, in the College of the Society, with great applause for eight years. The climate of Rome affecting his health, he obtained leave to return to his native country, in 1588, where he was appointed professor of theology in the University of Alcala, a situation which he held till 1596. On quitting Alcala he lectured for a year at Salamanca. The University of Coimbra in Portugal had, in the meantime, by repeated and urgent solicitations, obtained of Philip II. that Suarez should be appointed its principal professor of divinity. On his way thither Suarez received the degree of doctor in theology from the University of Evora. He arrived at Coimbra in 1597, and spent there the remaining twenty years of his life. His lucid arrangement, extraordinary memory, and fervid eloquence, rendered his lectures eminently popular. But the manner in which his contemporaries speak of him is calculated to leave an impression that his striking personal character had quite as great an influence in raising him to fame as his intellectual powers. He shunned rather than sought applause; he was indefatigable in his endeavours to render himself serviceable to others; he was guarded in his language, even when expressing himself under strong excitement; he was abstinent, both in regard to meat and drink; and the same enthusiasm which impelled him 'to take the order by storm,' continued to show itself unabated to the last, in his eager discharge of devotional offices. Of all his works, that which excited most attention in this country was, as might have been expected, the controversial treatise called forth by the defence of the oath of fidelity published by James I., 'Defensio Fidei Catholicæ et Apostolicæ adversus Anglicanæ Sectæ Errores, cum Responsione ad Apologiam pro Juramento Fidelitatis et Præfationem Monitoriam Serenissimi Jacobi, Angliæ Regis.' It appeared at Coimbra in 1613. It is the work of an enthusiastic recluse, who, deeply convinced of the truth of his principles, and accustomed to teach them as abstractions to youth, not to attempt to practise them amid the hindrances of real life, pursues them out to all their consequences with a bold and severe logic. The language is decorous, but the conclusions are stated without reserve or softening, and at the conclusion of each chapter an affectionate exhortation is addressed to King James, begging him to acknowledge their truth, and submit to them in practice. The king replied, not by publishing a rejoinder, but by having the book condemned to be burned in London. By order of the Parliament of Paris, it suffered the same fate in that capital in 1614. It was not such a work as political leaders in the court of Rome would have ventured to put forth; but it was such a one as they rejoiced to see put forth by their abstract thinkers, for whom they could apologise to sovereigns as well-meaning men, but ignorant of the world, and therefore not worth minding, at the same time that they reckoned, and not without cause, upon the good effects to be produced on public opinion by the single minded expression of a sincere enthusiast. The Romish politicians were in this perhaps no more insincere than secular politicians. With Suarez however it was perfect earnestness and conscientious conviction. When informed of the treatment experienced by his book, he expressed the enthusiastic wish that his body had enjoyed the privilege of bearing testimony to his faith by suffering the same fate; and he was in truth the stuff of which martyrs are made. His systematic works were after his death collected and published under the auspices of the Society in twenty-four volumes. The most important are:—four volumes on the chief end of man, in which he treats of the will, good and evil, virtue and vice, and sins; a volume on laws, and God viewed in his capacity of legislator; four volumes on grace, viz. on justification and the necessity of grace, on actual grace and the means of grace, on habitual grace and its effects, on the true meaning of efficaceous means of grace, &c.; two volumes of metaphysics, and one of commentaries on different works of Aristotle. The chief merits of the writings of Suarez are order and precision. His system is a modification of Molinism, with a view to obviate some of the objections urged against it by the strict adherents to the views of St. Augustin. The controversy between the Jesuits and the sectaries of that father, like that between the Arminians and Calvinists in the Reformed church, is parallel to the controversy between necessitarians and those who maintain the freedom of human action The scientific disputants appeal to human reason; the theologians, to revelation: with the one, it is an inquiry into the constitution of man; with another, into the will of the deity the former must decide by investigating natural phenomena and reasoning upon them; the latter, by critically investigating the language in which the revelation to which they appeal is couched. The qualities of mind elicited in theological controversy are acuteness and logical neatness. These are to be found in Suarez, nor is there anything in his writings to warrant the opinion that he possessed higher intellectual attributes. He was something more than a mere logician and verbal critic; but his greatness consisted in his elevation of sentiment, empassioned temperament, and energetic will. Suarez died at Lisbon, whither he had gone to make arrangements for the publication of his volumes on Grace, on the 25th of September, 1615. He is reported to have said on his death-bed, 'I did not think it was so easy to die.'

(*Life*, prefixed to the edition of Suarez's *Works*, published at Venice in 1740; *Bibliotheca Nova Scriptorum Hispanorum*, v. 'Franciscus Soarez.')

SUARROW-NUT. [CARYOCAR.]

SUBAPLYSIA'CEA, M. de Blainville's name for the first family of his MONOPLEUROBRANCHIATA, an order which he defines as having branchial organs of respiration situated at the right side of the body, and more or less completely covered by a part of the operculiform mantle, in which a shell, which is flat, or more or less involved with a very large

and constantly entire opening, is often developed; the tentacles null, rudimentary or auriculiform.

The following is M. de Blainville's definition of the family character of the Subaplysiceans:—

Two or four tentacular appendages to the head. Orifices of the organs of generation but little or not at all distant from each other, and without an intermediate external groove.

The genera comprised under this family are BERTHELLA, *Pleurobranchus* and *Pleurobranchidium*. [SEMIPHYLLIDIANS.]

The other families of this order are—2, *Aplysiacea*; 3, *Patelloidea*; and 4, *Akera*.

The *Aplysiacea* are defined as having a body not divided, or forming a single soft fleshy mass; four tentacular appendages, which are constantly very distinct, flattened, and auriform; mouth in the form of a vertical slit, with two lateral subcorneous labial plates, and a cordiform tongue rough with denticles; eyes sessile, between the two pairs of tentacles; branchiæ covered with a sort of operculum; orifices of the generative apparatus more or less distant, and united together by an external furrow.

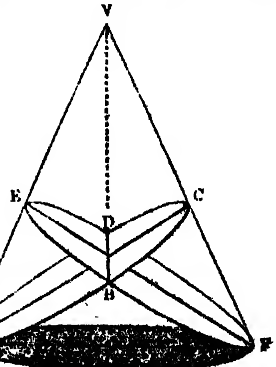
Shell null or incomplete, constantly internal.

The genera in this family are, according to M. de Blainville—*Aplysia*, *Dolabella*, *Bursatella*, *Notarchus*, and *Elysia*.

The third family, *Patelloidea*, consists of the genera *Umbrella*, *Siphonaria*, and *Tylodina*. The two first of these forms are treated of in the article SEMIPHYLLIDIANS.

The fourth family, *Akera*, comprises the genera *Bulla* [BULLADÆ], BELLEROPHON, *Bullæa*, *Lobaria*, *Sormetus*, *Gasteroptera* [BULLADÆ], and *Atlas*.

SUBCONTRARY. This word is applied particularly to the sections of a cone, in a manner which, without interfering with that use, would allow of its definition being generalised as follows:—When a figure or solid is symmetrical, so that equal lines or polygons can be drawn on two different sides, those equal lines or polygons may be called *subcontrary*. Thus in Euclid, i. 5, the equal lines, which are obliquely deflected from the two ends of the base of the isosceles triangle, are subcontrary. In a right cone every section has its subcontrary, except only the circle which generates the cone, and its parallels. Let V be the vertex of an oblique circular cone, and ABCD the circle on which it is described. Let the plane VAC be that which passes through the centre of the circle perpendicularly to its plane. Then the cone is exactly the same on one side of the plane VAC as on the other; and if a plane AGF be drawn through A perpendicular to the line which bisects the angle AVF, the section AGF is such that either half would take the place of the other, if it were to make a half revolution about AF. It is then an ellipse, of which AF is one of the principal axes; and the middle point of AF, falling in the line which bisects AVF, is the centre. Consequently every section of this cone has a subcontrary section, except only those which are parallel to AGF. Hence the generating circle ABCD has a subcontrary circle EBFD, made by taking the line EF subcontrary to AC, and drawing through EF a plane perpendicular to the plane AVF. The angles VEF and VCA are equal, as also VAC and VFE.



In the limited use of the word subcontrary, no sections are considered in this light except the two circular sections of an oblique cone. Consequently when subcontrary sections are mentioned, these circular sections are understood. The proofs given of the existence of these subcontrary sections usually conceal the fact of all cones described upon a circle being symmetrical when produced in every direction, and seem to make the existence of a second circular section a sort of accident of the circle, as if no other section had its subcontrary.

Since all parallel sections of a cone are similar, it follows that through every point of the surface two subcontrary circles can be drawn. The surfaces of the second order generally have the same property. [SURFACES OF THE SECOND ORDER.]

SUB-DOMINANT, in Music, the fourth of the key, mode, or scale. Thus, in the key of C, F is the Sub-Dominant.

SUBDUPLICATE, SUBTRIPLICATE, &c. [RATIO, p. 309.]

SUBERIC ACID, an artificial substance produced by treating rasped cork with diluted nitric acid; the cork is slowly dissolved, and a fatty substance is formed, which floats on the surface of the fluid. The solution is slowly evaporated till it thickens, and the residue is treated with about eight times its weight of water, by which an additional quantity of fatty matter separates. When the solution is filtered, suberic and oxalic acids separate, the former in the state of a white powder; this is to be saturated with ammonia, and the suberate of ammonia formed being decomposed by an acid, the suberic acid precipitates in the state of a white powder, which is to be washed with cold water. Suberic acid may also be obtained by treating margaric, oleic, or stearic acid with nitric acid. The properties of this substance are, that its acid powers are but feeble; it is very soluble in boiling water, and the greater part of it is deposited from the solution on cooling in the form of a white powder; it is soluble also in anhydrous alcohol; fuses at about 300°; and sublimes in acicular crystals.

According to Laurent, it is composed of—

Seven equivalents of hydrogen	7	or	8·05
Eight equivalents of carbon	48	..	55·17
Four equivalents of oxygen	32	..	36·78
Equivalent	87		100·

The suberates are not an important class of salts; we shall therefore mention them briefly. Suberate of ammonia is soluble in water; the suberates of potash and soda are deliquescent, and fusible without decomposition: those of lime, barytes, strontia, magnesia, alumina, and manganese are more or less soluble: protosuberate of iron is a white precipitate; the persuberate is a brown one: the suberates of tin, zinc, mercury, and silver are white insoluble substances: that of cobalt is red, of copper blue-green, and uranium yellow.

SUBERIN is a peculiar substance so named by Chevreul, as obtained from common cork, the epidermis of the *quercus suber*. When ten parts of cork have been treated with water, alcohol, æther, hydrochloric acid, potash, &c., there remain seven parts, which are suberin, possessing the following properties:—it is very inflammable; by distillation it yields water, a colourless oil, and afterwards a yellowish one, all of which are acid; then ammonia and a fatty crystallized substance are produced, and various gases are disengaged, while charcoal equal to one-fourth of the suberin remains in the retort.

SUBJECT, SUBJECTIVE.—These words, with their correlatives Object and Objective, are now again restored to English philosophical language, through the medium of the German writers. The Subject is in philosophy invariably used to express the mind, soul, or personality of the thinker—the Ego. The Object is its correlative, and uniformly expresses anything or everything external to the mind; everything or anything distinct from it—the non-Ego. The universe itself, when considered as a unique existence, is an object to the thinker; and the very subject itself (the mind) can become an object, by being psychologically considered.

The distinction is most important. The exact distinction between the terms subject and object was first made by the schoolmen; for by the Greeks the word ὑποκείμενον was equivocally employed to express either the object of knowledge (the *materia circa quam*) or the subject of existence (the *materia in qua*). These correlatives, subject and object, correspond to the first most important distinction in philosophy, viz. the original antithesis of self and not-self. These terms, in their substantive and adjective forms, passed from the schools into the scientific language of Tilesius, Campa-

nella, Gassendi, Descartes, Spinoza, Leibnitz, Wolff, and others.

These terms however gradually lost their primary signification, and this owing to the ambiguous manner in which the terms were used. Besides its primary signification, object became metaphorically *motive, end, final cause*, &c., by a common change in all language, of the metaphor into a real signification. Subject also became synonymous with object, and probably the logical terms 'subject of predication' facilitated this confusion. Be this as it may, the extreme want of precision with which the words are used, may be seen in the very common instance of calling anything 'a subject of investigation.'

SUBLIMATION, a chemical operation effected by the application of heat to certain bodies; it is essentially similar to distillation in principle, but differs from it in the nature of the substances to which it is applied. In distillation liquids are converted into vapour, and condensed into the same form by the cooling agency of water; whereas in sublimation solid bodies are vaporized, and afterwards reassume the solid state, in general merely by the cooling power of the air, without the assistance of cold water.

Sublimation is usually conducted in one vessel, the product being deposited in the upper part of it in a solid state, while the impurity remains in the lower. In small experimental researches a Florence flask answers perfectly well, and a good exemplification of the process is that produced by heating iodine in it: a purple vapour rises, which almost immediately condenses in small brilliant dark-coloured crystals in the upper part of the flask, the impurity remaining in the lower.

Sublimation is extensively employed, and for two different purposes; the simplest case is that of using it for purifying a substance, camphor for example, in which the pure camphor is vaporized, and condenses in the upper part of the vessel, while the impurities remain in the lower part.

In preparing corrosive sublimate and calomel, these substances are formed and sublimed by the same operation: in general large green-glass vessels, called *boltheads*, are used for calomel and corrosive sublimate; while for camphor very thin flint-glass vessels are used, which are called *bombolos*, from the Italian *bombola:* in both cases a vessel is broken after each operation, to obtain the product. Among other substances procured by sublimation is benzoic acid, formerly called *flowers of benjamin*. This acid is sublimed in much larger vessels, and not usually made of glass; while the vapour of sulphur is condensed in a large chamber, or sulphur-house, and adheres to the walls in the form of a fine powder, and known by the name of *sublimed sulphur*, or *flowers of sulphur*.

SUBLIME. (Geometry.) It may be worth while to state in few words, and to prevent a reader of the older mathematicians from imagining that they spoke rhapsodically, that the term *sublime geometry* was technical, meaning the higher parts of geometry, in which the infinitesimal calculus or something equivalent was employed.

SUBLIMITY has two significations: one, that of the quality or circumstance in objects, which raises the emotion named sublimity; the other, that of the emotion itself. In no modern philosophy, except the Scotch, could this distinction in language, for the sake of convenience, have been taken for an equivalent distinction in thought. Yet this distinction has been combated as an error, by almost all the Scotch writers—Kames, Stewart, Brown, Alison, Jeffrey, &c.—when the truth is, no such error was ever entertained by any correct thinker. The generality of people may conceive beauty and sublimity to be qualities of objects without respect to their emotions, as they regard sound, taste, smell, &c. to be qualities of objects without respect to the senses; for the law of the common mind is eminently what the Germans call an objective tendency, that is, a tendency to believe in its own sensations and emotions as *things* distinct from themselves, but no philosophical thinker of the last century has ever fallen into this error, and when Dr. Thomas Brown refutes, with so much pretension, the 'theory of the one universal sublime as a specific object to which there is a corresponding faculty of perception in the subject, he is combating a chimæra.

But the nature of the sublime, that is, those conditions of objects which invariably excite in us certain emotions, to which we give the common name of sublimity, is a subject of great interest and importance in psychology, and has always been a favourite subject of speculation. We shall briefly notice the more celebrated theories which have professed to embrace and explain all 'those conditions which excite the emotions,' and endeavour to point out their failures.

Longinus, whose work (Περὶ ὕψους) is the most antient, treats only of the sublime in writing. His treatise was meant as a supplement to the work of Cæcilius on the 'Sublime,' in which he says Cæcilius brought a number of instances to show what is the sublime, as if every one did not know that well enough.

Burke's 'Inquiry into the Sublime and Beautiful' was the first attempt to give philosophical precision to our notions of the sublime. His theory is, that the essence of the sublime consists in terror operating either openly or latently; and the delight which is caused by this terror is referred to those principles of human nature which he calls 'passions of self-preservation,' and which turn on pain and danger. These passions 'are simply painful when their causes immediately affect us; they are delightful when we have an idea of pain and danger, without being actually in such circumstances: this delight I have not called pleasure, because it turns on pain, and because it is different enough from any idea of positive pleasure—whatever excites this delight I call sublime.' (*Inquiry*, part i., sect. 18.) 'Whatever therefore is terrible, with regard to sight, is sublime too, whether this cause of terror be endued with greatness of dimensions or not.' (*Ibid.*, part ii., sect. 2.) Nothing can be more explicit than these two passages, nor more accurately exhibit the truth and error of his theory. The error is glaring in the second passage. Terror is often one feeling, exciting, in conjunction with other feelings, the emotion of sublimity, but not always. The stars are sublime, yet there is no terror in the emotion they excite. On the other hand there is a terror in a surgeon about to operate, or in a pedagogue about to flog—but no sublimity. The gallows is very terrible, but not at all sublime. Yet Burke was so chained down by his theory of terror being the ruling principle of the sublime, as to write—'There are many animals who, though far from being large, are yet capable of raising ideas of the sublime, because they are considered as objects of terror—as serpents and poisonous animals of all kinds.' (*Ibid.*, part ii., sect. 2.) Now, when a man asserts that a serpent is sublime, *because* it is terrible, it is evident that he uses the word sublime in a different sense from the rest of the world; otherwise we say a serpent is in no case sublime.

The better to see how independent the sublime is of any danger manifest or implied, let us take a shower of rain and the stars. A shower of rain is certainly not sublime, yet there is danger implied in it, that is, catching your death of cold. The stars are sublime, without a particle of danger either manifested or implied. Terror then is not the ruling principle of the sublime.

That the terrible is often a constituent of the sublime there can be no doubt, and Burke's error consists in seizing this occasional constituent, and declaring it to be the 'ruling principle.' And further, we must observe, that whenever a feeling of terror is found to be a constituent of the sublime, there will also invariably be found another feeling of security, correcting this terror. Thus, when we stand beneath a rock, the terror consists in a natural apprehension of its falling down and crushing us, which apprehension is instantly checked by our feeling of security and confidence of its not falling. If this feeling of security did not momently check the feeling of terror, the effect would be terror only, and not sublimity, and we should escape from it as swiftly as possible. To witness a storm from a place of shelter is sublime, because our terror is checked by the feeling of security; but if the shelter be one which will not probably withstand the violence of the storm, and thus destroys our confidence, or if we be shelterless and fear the storm, then the effect will be that of pure terror, and not that of sublimity. A sleeping lion is sublime, and there is in that emotion a double feeling of security and danger. If the lion awakes, terror alone is the result, and absorbs every other feeling.

So universal is this accompaniment of a feeling of security correcting the feeling of danger in every case of sublimity wherein terror is a constituent, that we are as much justified in asserting that 'a feeling of security, either operating openly or latently, is the ruling principle of the sublime,' as Burke was in his theory of terror. And we might define sublimity as the 'effect of security.' This sounds

ridiculous, but it contains a portion of the truth, and just that portion of it which Burke's celebrated theory possesses. If terror had been found to be an invariable element of the sublime, the correct statement of the theory would have been—'The sublime is the effect of the concurrence of the two feelings of danger and security.' But unfortunately there are many cases in which no feeling of danger can be found to exist. Infinity and eternity are sublime; but although, as he says, 'infinity has a tendency to fill the mind with that sort of delightful horror which is the most genuine effect and truest test of the sublime,' yet it does not necessarily fill the mind with horror; it may or may not, but in either case it is sublime. Helvetius says, 'When God said, "Let there be light, and there was light:" this image is sublime. But should such an image inspire fear? Yes; because it is necessarily associated in our minds with the idea of the Creator of such a prodigy; and being then seized in an involuntary manner with a dread of the author of light, we feel the sensation of a commencing terror.' (*On Man*, vol. ii., p. 227.) Now we contend that although fear would arise from such a train of thought, yet this train of thought is by no means a *necessary* sequence to the image—'God said, Let there be light, and there was light.' It may or may not arise in the mind, but the sublimity produced by the image is not at all dependent upon it. Even admitting that it is a necessary sequence, there are still too many cases of the sublime destitute of terror, not to overturn Burke's theory.

Lord Kames has a chapter in his 'Elements of Criticism,' on the sublime. He says, 'A beautiful object *placed high*, appearing more agreeable than formerly, produces in the spectator a new emotion, termed the emotion of sublimity; and every other emotion *resembling* this emotion of elevation is called by the same name.' He has here the mere etymological notion of sublimity as something elevated. (See Dr. Parr's observations on the derivation of sublime from *su ra limum*, in the Appendix to Dugald Stewart's *Philos. Essays*.) That there is little to be learnt from such an inquiry is evident.

Mr. Knight, in his 'Analytical Inquiry into the Principles of Taste,' puts forth the theory that the sublime is the effect of the influence of *mental energy* exciting a sympathetic energy in the mind of the spectator or reader. The objections to this are the same as those to Burke's theory, namely, that it embraces a portion of the truth, which it would substitute for the whole truth. We have only to reflect an instant, and numberless instances of the sublime arise in which no mental energy is implied. Solitude, for example, is certainly sublime; so are infinity, eternity, Mont Blanc, &c. Mental energy is perhaps a more comprehensive formula for sublimity than terror, but it is still incomplete; and if one instance of sublimity can be quoted which does not contain the element asserted to be its 'ruling principle,' it is obvious that the theory must be erroneous.

Dugald Stewart's 'Essay on the Sublime' is entirely philological, and as such alone worthy of attention.

Dr. Thomas Brown combats the notion of a universal sublime, but avoids the real question altogether. All that is positive in his lecture on the subject is that the sublime and beautiful are not two distinct classes of emotions, but the same class, differing only in degree. 'It is,' says he, 'as in the thermometric scale, by adding one portion of caloric after another, we arise at last, after no very long progress, from the cold of freezing to the heat at which water boils; though our feelings at these two points are as different as if they had arisen from causes that had no resemblance; certainly as different as our emotions of sublimity and beauty.' (*Lectures on Philos. of Mind*, lvii.) Nothing can well be more erroneous than to take an analogy as a proof. Misled by his analogy, Dr. Brown has falsified the whole nature of the sublime, which according to him is but a larger or intenser form of the beautiful, whereas it differs essentially and antagonistically. He takes the instance of a stream gently gliding through fields rich with all the luxuriance of summer, overshadowed at times by the foliage that hangs over it from bank to bank. This is beautiful. He then traces it on to a majestic river, which flows on and deposits itself in the ocean. Here it becomes sublime. And this sublimity he thinks merely the last in the progressive series of emotions, as the boiling-point is the last in the progressive series of ascending heat. 'If we were to contemplate this continued progress, we should have a series of emotions which might at each moment be similar to the preceding emotion; but which would become at last so different from our earliest feelings, that we should scarcely think of them as feelings of one class.' (*Ibid.*)

The answer to this is, that upon a similar principle of analogical reasoning, you might trace the 'progressive series' of feelings which the man underwent from his earliest childhood; and when this series had conducted him to the gallows, you might say that his feelings at that moment were so different from his earliest feelings, that we should scarcely think of them as feelings of one class. Probably not. Nor should we, in our ethical philosophy, class the crimes which brought him to the gallows, with the innocence which commenced the 'progressive series' of his emotions.

The whole of Dr. Brown's lecture on this subject is trivial or confused; and because he is unable to analyse the feeling itself, he boldly pronounces it not to be analysed. 'It is the vain attempt to define what cannot be defined,' he says, 'that has led to all the errors and supposed mysteries in the theory of sublimity. Sublimity is not one emotion, but various emotions, that have a certain resemblance—the sublime in itself is nothing; or at least it is only a mere name, indicative of our feeling of the resemblance of certain affections of our mind, excited by objects material or mental, that agree perhaps in no other circumstance, but in that analogous undefinable emotion which they excite.' We maintain, on the contrary, that sublimity is *one* emotion, not various similar emotions. It is itself complex, made up of various feelings; but it is one specific feeling, which preserves its characteristic throughout the various shades of difference in the objects which excite it. Dr. Brown thinks, because various objects, differing amongst each other, excite separately feelings of sublimity, that therefore what we call the sublime is but the general classification of those feelings under one name: as A, B, C, D, and the rest, are classed under the word alphabet. Now we contend, and shall shortly endeavour to prove, that the sublime, or that emotion which men have consented to call the feeling of the sublime, is ever one, whatever varieties of feeling may concur with it; that is to say, whether power, terror, magnitude, or mental energy, together or separately, form constituents of each individual emotion of sublimity, nevertheless there is always underneath these, one specific characteristic feeling which renders it not merely an emotion of power, or terror, or magnitude, but of sublimity. Thus A, the sublime, is always A. Whether the word be And, Also, Apt, All—whatever be the sequent letters, A remains A unaltered. This one specific characteristic (A), which of itself constitutes the difference between an emotion of sublimity and one of terror, has been sought for by most of the writers on the subject. Burke thought it was the terrible; Helvetius, that it was a terror just begun. Knight, that it was mental energy; Price agreed with Burke; Kames, that it was a sense of elevation; and Alison, that it was association of ideas. Only Dr. Brown was illogical enough to class the repetition of one feeling as a number of different feelings resembling each other. Finding that A was sometimes followed by *lso*, *pt*, and *ll*, as well as by *nd*, he declared that the A in these words 'and, also, apt, all' was not the same letter, but merely resembled each other. But this is a consequence of his dogma of the similarity of the sublime and beautiful, which he declares to differ only in *degree*, whereas they differ in *kind;* and of his notion of a 'progressive series,' whereby the ocean and streamlet excite the same class of emotions.

Mr. Alison's 'Essays on the Principles of Taste' avoid the real question of sublimity, and the same must be said of his eloquent reviewer Francis Jeffrey, who sums up his theory in these words: 'The emotions which we experience from the contemplation of sublimity or beauty are not produced by any physical or intrinsic quality in the objects which we contemplate; but by the recollection or conception of *other* objects which are associated in our imaginations with those before us, and consequently suggested by their appearance, and which are interesting or affecting, on the common and familiar principle of being the natural objects of love, or of pity, or of fear or veneration, or some other common and lively sensation of the mind.' (*Edin. Rev.*, vol. xviii., p. 2.)

The first part of this passage is either a truism or an absurdity. A truism, if it be meant to state that as a mere sensation (without any respect to all the sentient being had

previously undergone, and which that sensation would necessarily excite) an object in itself is not sublime (a truism however which Mr. Alison asserts to be the conclusion on which his speculations rest: chap. v., sec. 6). An absurdity, if it be meant to state that an object has no intrinsic quality capable of exciting that emotion. The size of a rock, for instance, is the condition of its sublimity; so with the cataract—make it a waterfall, and it ceases to be sublime, yet this difference of size is surely an intrinsic quality in the object which excites the emotion?

The fundamental principle of Mr. Alison's theory is 'that all objects are beautiful or sublime which signify or suggest to us some simple emotion of love, pity, terror, or any other social or selfish affection of our nature; and that the beauty or sublimity which we ascribe to them consists entirely in the power they have acquired by association or otherwise of reminding us of the proper objects of these familiar affections.' (*Ibid.*, and Alison's *Essays*, i.)

This theory is in the highest degree vague. It does not discriminate what constitutes the sublime—it does not analyse that complex emotion and draw forth its characteristic, and moreover in its sweeping generality includes much that it cannot apply to. All objects which excite terror are not beautiful nor sublime; neither are all objects which excite pity beautiful, and so of the rest. To discriminate those which are from those which are not, is impossible on this theory. To resolve the emotion of sublimity into association of ideas, is to say that this special emotion is resolvable into the general law of the human mind, but to avoid an analysis or characteristic statement of this special emotion altogether. It is saying that theft is a crime, and referrible to the general law of criminality, without once demarcating what constitutes theft as a crime, distinguished from murder as a crime. Attraction is the law which regulates the descent of an apple, and association of ideas in like manner is the law which regulates the operation of memory and the flights of imagination; yet as memory and imagination are distinct from the general law, as well as from each other, so also is the emotion of sublimity distinct from the emotion of hatred or beauty. Burke, Knight, Kames, and Price endeavoured to ascertain this distinction. Brown overlooked it, and Alison evades it. Had the special law of sublimity been found, and it was then attempted to be classed in its relation to the general law of the mind, the efforts of Mr. Alison and Mr. Jeffrey would have been of great importance; but in the meanwhile it was assumed.

It appears to us that the true method of attaining the knowledge of this special law of emotion, is the method of all psychological inquiries, viz. induction. Before attempting to detect the law which regulates it, we must collect all, or a vast number of instances of the sublime, and analysing the elements of each case, endeavour to discover *one* primal element which is invariably a constituent of the emotion, and without which all the other constituents would not be able to form that special emotion of sublimity.

In noticing the theories of former writers we have found their inductions imperfect; they have selected too few instances, and consequently when we came to select others, these theories were subverted by the mere statement of them. It was sufficient to disprove the theory of terror, to quote one instance wherein the terrible had no place, and the same with the theory of mental energy. But these theories, though incomplete, contain much that is true in their analyses.

In proposing a new theory, founded on a wider range of induction, we may observe that if any one instance of the universally acknowledged sublime can be found in which no such element (as the one we assert to be the ruling principle) be detected, then that single instance is a proof of the incompleteness of our theory, and a more extensive induction will be necessary.

It will be necessary for the sake of clearness to make use of purely mental distinctions in treating this subject, though they are liable to be misinterpreted as real distinctions; accordingly we divide the question of the sublime into three:—1. The material sublime—or the sublime of nature. 2. The moral sublime—or the sublime in human actions and ideas. 3. The emotion of sublimity, which these external things excite in us—or that feeling in the mind which gives to certain phenomena of nature, or deeds of man, the attribute of sublimity. Speaking *objectively*, the exciting cause of sublimity is vastness; speaking *subjectively*, the emotion excited is a sense of insignificance.

I. The material sublime. Examine every case of material sublimity, and the most primitive fact will be found to be vastness; whatever feelings may simultaneously concur, this of vastness is invariable. Mere vastness is sublime. Vastness either of form or of power. Hampstead Heath is not sublime, but Mont Blanc is. The Thames is not sublime, but the ocean is. Yet to show how little terror has to do with the emotion, we all know that there is as much danger on the Thames as on the ocean when it is calm. Solitude is sublime—because it is vast, that is, indefinite. But solitude in a room or garden is not sublime. A cataract is sublime, but not a waterfall, yet the one is only larger than the other. Longinus has remarked that the sight of a small fire produces no emotion, but that the boiling furnaces of Ætna, pouring out whole rivers of liquid flame, is sublime. Burke remarks that all general privations are sublime because terrible, such as vacuity, darkness, solitude, and silence. But they are sublime because vast, not because terrible; for they are not necessarily terrible, and they are necessarily vast, indefinite.

These instances are sufficient to illustrate the principle. It will be observed that there are some which seem more naturally to derive their sublimity from terror than from vastness, as Ætna for example. But our object was to show that vastness was always a constituent, even when other emotions came into play; and as we have already seen instances where terror does not form one constituent, and that when it does form one, it is still accompanied by vastness, so we prove thereby that vastness is the more general fact. Vastness is sublime as vastness; but terror is not sublime as terror. The difference between a shower and a storm is purely quantitative, yet the storm alone is sublime.

II. The Moral sublime. It is obvious that the moral sublime must differ from the material sublime in proportion as mind and matter differ. Hence vastness, which in the external world is superficial (*in extenso*), in the moral world becomes intense (*in intenso*). Intensity of will equals vastness of form or power. Mere intensity is sufficient to produce the sublime. Œdipus is sublime. Lear, who appeals to the heavens, 'for they are old' like him, is sublime, from the very intensity of his sufferings and his passions. Lady Macbeth is sublime from the intensity of her will, which crushes every female feeling for the attainment of her object. Scævola with his hand in the burning coals exhibits an intensity of will which is sublime. So the celebrated 'qu'il mourut' of Horace in Corneille's tragedy, where a father's love is conquered by a more intense feeling of the honour of his country. It will be difficult to find terror as an element of these cases of the sublime. Mr. Knight's 'mental energy' has here more truth; but though a satisfactory explanation of the moral sublime, yet it will not apply to the material sublime.

Such appear to us to be the objective qualities of sublimity, but the peculiar emotion they excite has hitherto been thought undefinable: we shall nevertheless attempt it.

III. The emotion of sublimity. As in considering objectively every case of material or moral sublimity, we found as the primary and invariable fact vastness or intensity, so in considering subjectively every case of sublimity as an emotion, we shall find the primary and invariable fact to be a sense of our own insignificance; of our inferiority to the object, or to the will which prompted the deed; and this sense of inferiority has guided mankind in the employment of a word expressing elevation for sublimity. Mere vastness excites this emotion by exciting a corresponding sense of our smallness. Mere intensity excites this emotion by exciting a corresponding sense of our feebleness. Vary the objects—vary the emotions as you may, there will invariably be this one feeling of comparative insignificance. Take as an example the sublime words of Scripture, 'I am the High and the Lofty One, who inhabiteth eternity.' Nothing can exceed the grandeur of that idea, and he who conceives it conceives also, at the same time, the corresponding idea of his own small and finite nature. In the violent dashing of a cataract, in the roar of the ocean, in the violence of the storm, or in the majestic quiet of Mont Blanc preserving its calm amidst all the storms that play around it, or in the concentrated will of a Scævola, Horace, Brutus, or Œdipus, in all these cases we are moved by a vivid feeling of some greater power than our own, or some will more capable of suffering, more vast in its strength than our feeble vacillating will. It is from this reason that an imaginative mind experiences more emotions of sublimity than another. In

proportion as we comprehend the majesty of nature, or the amount of self-sacrifice in an heroic action, we comprehend our own inferiority to them.

To take another instance of the sublime—a sleeping lion. The grandeur of the lion arises from his known courage and power. He has an intensity of will, and of strength to execute that will, which we feel immensely to exceed our own. But a caged lion is no longer sublime. And why? Because he is conquered. Man has conquered and caged him. His boasted will and strength have not availed him against the power of man. Our feeling of inferiority has vanished. Had the lion-tamers Van Amburgh, Martin, &c. seen a sleeping lion, they would have probably felt little emotion of sublimity.

When Mr. Knight says that the sublime is the effect of mental energy exciting a sympathetic energy in the mind of the spectator or reader, he mistakes a frequent effect for the cause. Sympathetic energy often follows an emotion of sublimity, but not always. It does not follow the emotion of sublimity produced by infinity, eternity, night, or the emotion excited by the passage, 'God said, Let there be light, and there was light.' So far then from 'filling the reader with a glorying and sense of inward greatness,' as Longinus and Knight assert—it fills him with a sense of weakness and inferiority. We admit that any manifestation is delightful for its own sake, but this sympathetic delight is a principle of human nature which does not come within the question of the sublime. But whether sympathetic energy follow the emotion of the sublime or not, it is never the cause of that emotion.

Dr. Brown, Mr. Alison, and Mr. Jeffrey contend for the identity of the sublime, beautiful, and picturesque, led thereto by their resolving them into association of ideas, instead of distinguishing them as special emotions. We contend that the sublime and the beautiful are two very distinct and dissimilar emotions. The beautiful is founded on emotions of the pleasurable, and its varieties are as infinite as the varieties of objects which excite pleasurable emotions. The sublime is founded on an emotion of our insignificance, and its varieties are as limited as the varieties of objects which excite the feeling of insignificance. The beautiful they rightly assert to be the principle of suggesting some past or possible emotion of some sentient being; but they are wrong in asserting the sublime to be the same principle, for the sublime is not founded on any past and pleasurable emotions which the object may excite (as the ruddy cheek of a girl suggests the pleasurable emotions of health and youth, and therefore is beautiful), but is founded on the double feeling of power and insignificance. This emotion may be pleasurable, as almost all emotions are, but the pleasure derived from the manifestation of power is not the foundation of the emotion. The sublime and the beautiful are identified in the more general law of the association of ideas.

In conclusion we may thus sum up our theory. The invariable condition of sublimity in objects, either material or moral, is vastness or intensity. The invariable condition of the emotion of sublimity—that which distinguishes this emotion from every other emotion—is a comprehension of this vastness with a simultaneous feeling of our own comparative insignificance, together with a concomitant sense of present security from any danger which might result from this superior power. The antithesis to the emotion of sublimity is the emotion of contempt.

SUBMARINE DESCENT. Much ingenuity has been devoted from an early period to the contrivance of apparatus for enabling men to dive, or descend beneath the surface of water, to a greater depth, for a longer space of time, and with less exertion and danger, than is possible by the unassisted powers of the body. The fatal consequences of continued submersion have been described under ASPHYXIA [vol. ii., p. 490], and DROWNING [vol. ix., p. 157]; and from the facts there stated it is evident that about half a minute is the longest period during which most individuals can safely remain under water, without some provision for the supply of air for respiration. Experienced divers may remain under water much longer, though not without great and painful exertion; but the longest period of submersion, with a few extraordinary exceptions, does not exceed two minutes; a space of time too brief to allow the performance of any but the simplest operations beneath the surface of the water. The pearl-fishery affords the most prominent example of the employment of divers unassisted by apparatus for providing a supply of air. The mode of diving adopted, and the effects of protracted submersion upon the divers, are described under PEARL FISHERY [vol. xvii., p. 349]. Professor Beckmann alludes to the employment of divers in antient times to assist in raising anchors, in recovering goods from wrecks, or such as had been thrown overboard in times of danger, and in destroying the works and ships of the enemy in time of war, as well as in fishing for pearls; but some of the statements quoted by him are evidently much exaggerated, as they speak of divers remaining for hours under water. Six minutes is about the longest time of submersion of which any authentic account has appeared in modern times. [PEARL FISHERY.]

Dr. Halley, in a paper printed in No. 349 of the *Philosophical Transactions* (vol. xxix., p. 492), entitled 'The Art of Living under Water,' observes that the divers for sponges in the Archipelago were accustomed to take down in their mouths a piece of sponge soaked in oil, by which they were enabled to dive for a longer period than without it. As the bulk of the sponge must diminish the quantity of air which the diver could contain in his mouth, it does not appear probable that this practice could assist respiration. It has been more recently explained (*Ency. Brit.*, art 'Diving') as a means for assisting the diver to see when under water. In still water light is transmitted freely to a great depth; but when the surface is disturbed by waves, it is much obstructed. To ensure a good light, which may enable the diver to find the objects of his search without delay, it is stated that he ejects a little oil from the sponge; and this oil rising to the surface, and spreading upon it, calms the waves in a most remarkable manner, and occasions a brilliant light at the bottom.

In connection with diving by the unassisted powers of the body, allusion may be made to a curious and important fact related in the *Encyclopædia Britannica*, on the authority of Professor Faraday, to whom it was first noticed by a gentleman connected with the Asiatic Society. The lungs are, in their natural state, charged with a large quantity of impure air; this being a portion of the carbonic acid gas which is formed during respiration, but which, after each expiration, remains lodged in the involved passages of the pulmonary vessels. By breathing hard for a short time, as a person does after violent exercise, this impure air is expelled, and its place is supplied by pure atmospheric air, by which a person will be enabled to hold his breath much longer than without such precaution. The writer states that although he could only hold breath, after breathing in the ordinary way, for about three-quarters of a minute, and that with great difficulty, he felt no inconvenience, after making eight or ten forced respirations to clear the lungs, until the mouth and nostrils had been closed more than a minute and a half; and that he continued to hold breath to the end of the second minute. A knowledge of this fact may in many cases be of great importance, as it may enable a diver to remain under water at least twice as long as he otherwise could do. It is suggested that possibly the exertion of swimming may have the effect of occasioning the lungs to be cleared; so that persons accustomed to diving may unconsciously avail themselves of this preparatory measure.

Another important fact, related in the same work, indicates the advantage of breathing condensed air, and thereby obtaining a larger supply of oxygen in the same bulk than with air of the ordinary pressure. After one of the disastrous occurrences at the works of the Thames Tunnel, Mr. Brunel, the engineer, descended in a diving-bell to examine the breach made by the irruption of the river into the tunnel. The bell descended to the mouth of the opening, a depth of about thirty feet; but the breach was too narrow to allow it to go lower, in order that the shield and other works, which lay eight or ten feet deeper, might be examined from the bell. Brunel therefore took hold of a rope, and dived below the bell for the purpose. After he had remained under water about two minutes, his companion in the bell became alarmed, and gave a signal which occasioned Brunel to rise. On doing so he was surprised to find how much time had elapsed; and, on repeating the experiment, he ascertained that he could with ease remain fully two minutes under water; a circumstance accounted for by the condensation of the air in the bell, from which his lungs were supplied by the pressure of a column of water nearly thirty feet high, which would condense the air into little more than one half of its usual bulk.

Many plans were suggested for enabling persons to remain for a longer period under water than is possible by the natural powers of the body, long before extensive use was made of any of them. Beckmann alludes to a passage of Aristotle (problem xxxii. § 5), which has been supposed to intimate that in his time divers used a kind of kettle to enable them to continue longer under water; but this passage is variously rendered by different translators, and Beckmann appears to place little reliance upon it. He states that the oldest information we have respecting the use of the diving-bell in Europe is that of John Taisnier, quoted by P. Gaspar Schott. It occurs in the 'Technica Curiosa, sive Mirabilia Artis,' &c. of Schott, which was published at Nurnberg, in 1664, lib. vi., cap. ix., p. 393, and is taken from the 'Opusculum de Motu Celerrimo' of Taisnier, who says, 'Were the ignorant vulgar told that one could descend to the bottom of the Rhine, in the midst of the water, without wetting one's clothes or any part of one's body, and even carry a lighted candle to the bottom of the water, they would consider it as altogether ridiculous and impossible. This however I saw done at Toledo in Spain, in the year 1538, before the emperor Charles V. and almost ten thousand spectators. The experiment was made by two Greeks, who, taking a very large kettle suspended by ropes with the mouth downwards, fixed beams and planks in the middle of its concavity, upon which they placed themselves, together with a candle. The kettle was equipoised by means of lead fixed round its mouth, so that when let down towards the water no part of its circumference should touch the water sooner than another, else the water might easily have overcome the air included in it, and have converted it into moist vapour.'* Schott calls the machine described, 'Cacabus aquaticus,' or an 'aquatic kettle;' but he also describes an apparatus called 'Lorica aquatica,' or 'aquatic armour,' which would enable those who were covered with it to walk under water, and which he seems to prefer to the 'cacabus aquaticus' previously described.† This apparatus is represented in plate 31 of Schott's work, which shows a man walking into the water with a covering like a small diving-bell over his head, descending nearly to his feet.

In England, without noticing the supposed contrivance of a diving-machine by Roger Bacon, it is evident that the diving bell was known at an early period. It is mentioned by Lord Bacon (*Novum Organum*, lib. ii., § 50; and *Phænomena Universi*, p. 702) as a machine used to assist persons labouring under water upon wrecks, by affording a reservoir of air to which they might resort whenever they required to take breath.

Some curious information on submarine operations is given in the postscript to a little volume published at Edinburgh, in 1688, by George Sinclar, 'sometime Professor of Philosophy in the College of Glasgow,' entitled 'The Principles of Astronomy and Navigation.' The postscript contains an account of how 'to buoy up a ship of any burden, from the ground of the sea,' and states that among those who had, in this nation, attempted to recover property from wrecks by diving, was the late Marquis of Argyle, 'who, having obtained a patent from the king, of one of the Spanish Armado, which was sunk in the Isle of Mull, anno 1588, employed James Colquhoun, of Glasgow, a man of singular knowledge and skill in all mechanical arts and sciences.' 'This man,' he proceeds, 'not knowing the diving-bell, went down several times, the air from above being communicated to his lungs by a long pipe of leather. He only viewed and surveyed the ship, but I suppose buoyed nothing up.' Sinclar subsequently states that about 1664 the (then) late Lord Argyle employed an ingenious gentleman, the laird of Melgim, who went down with a diving-bell and got up three guns. A third and more successful trial was made, he says, several years after; and, still later, one Captain Smith was so confident of obtaining the gold supposed to be lost with the ship, that he would not admit a co-partner in the enterprise; which however came to nothing. Sinclar proposed to raise wrecks by the buoyancy of arks or boxes, open at the bottom, which were to be sunk full of water, and then filled with air either by sending down casks of air; by bellows and a long tube; or otherwise. He alludes to the occasional use of casks for the purpose of raising vessels, and explains why, when at a great depth, they are liable to be crushed by the pressure of the water, showing that, by allowing the water to enter by a hole in the lower part of the cask, it would so compress the air as to produce an equilibrium of pressure, and thereby preserve it from fracture.* About the time that the work above quoted was published, William Phips, who subsequently became governor of New England, attempted to raise treasure from the wreck of a Spanish ship sunk on the coast of Hispaniola. What was the precise character of his apparatus, we are not informed. His earliest experiments failed, but he was so confident of success, that he sought for assistance to enable him to prosecute his scheme. He at length obtained the patronage of the Duke of Albemarle, son of the celebrated Monk, and in 1687, after many difficulties, he succeeded in raising a large quantity of treasure, with which he returned to England; where he was honoured with knighthood for his enterprise. Most accounts state that the property he recovered amounted to 200,000*l.*; but in the 'Life of Sir William Phips,' published anonymously in 1697, but attributed to Increase Mather, it is stated as 300,000*l.* It is unnecessary to cite further instances of the use of diving apparatus, or to notice other early authors who have mentioned the diving-bell, excepting to observe that Beckmann alludes to engravings in editions of Vegetius on the art of war, published in 1511 and 1532, representing a diver with a cap, from which rises a long leathern pipe, terminating in an opening which floats upon the surface of the water; and to a figure published in a work on fortification, by Lorini, in 1607, which nearly resembles the modern diving-bell. Beckmann considers the insertion of the former as a proof that the person who drew them was not acquainted with the diving-bell, which he would otherwise have delineated. The machine described by Lorini consists of 'a square box bound round with iron, which is furnished with windows, and has a stool affixed to it for the diver.' Lorini, who was an Italian, does not lay claim to the invention of this apparatus.

Dr. Halley, in the paper before alluded to, in No. 349 of the 'Philosophical Transactions,' describes the defects of the diving-bell, as previously used, and suggests a remedy for them. This paper alone would be sufficient, although it does not enter into the early history of the machine, to contradict the erroneous statement which has been made to the effect that Halley was the inventor of the diving-bell.

In its simplest form the diving-bell is a strong heavy vessel of wood or metal, made perfectly air and water tight at the top and sides, but open at the bottom. If such a vessel be gradually lowered into the water, in a perfectly horizontal position, the air which it contains cannot escape, and therefore the vessel cannot become full of water. This may be readily illustrated by plunging a glass tumbler, in an inverted position, into a vessel of water, and placing a bit of cork, or any other substance which will float on the surface of the water, under the glass. If a bit of burning matter be laid upon the cork-float, it will be seen that it continues burning, although the glass and all that it contains be plunged far beneath the water; thereby proving that the upper part of the cavity of the glass is occupied by air, and not by water. In this experiment however it will be observed that the water does fill a small part of the cavity of the glass, and that it rises more into it when it is plunged to a considerable depth than when the rim is only just immersed beneath the surface. This is occasioned by the condensation of the air contained in the glass, which, being very elastic and compressible, is condensed into a smaller space by the pressure of the superincumbent water, when the glass is plunged to a considerable depth, than it will occupy under the ordinary pressure of the atmosphere. Where the diving-bell is used for descending to a very small depth, as the pressure of the water is small, it will not rise in the bell to a sufficient height to be inconvenient; but at the depth of thirty-three feet the pressure is so great as to compress the air into one-half its original volume, so that the bell will become half full of water; and at a greater depth the air will be still more compressed, and the water will rise proportionately higher in the bell. This condensation of the air does not materially interfere with respiration, provided the descent of the bell be very gradual, as the air then in-

* We quote from the translation in the English edition of Beckmann's 'History of Inventions,' by William Johnstone, second edition, 1814, vol. i., p. 184.

† His words are: 'Longè melior est alia illa, quam ex Francisco Kŏslero proponit *Daniel Schwenterus* in Deliciis Mathematicis,' Part 12, prop. 15.

* Beckmann quotes not from this work, but from one published at Rotterdam, in 1669, entitled 'G. Sinclari Ars nova et magna Gravitatis et Levitatis;' from which, he states, the description of the diving-bell was transcribed into Sturm's 'Collegium Curiosum.'

sinuates itself into the cavities of the body and balances the pressure from without. The principal effect of the increased pressure is a pain in the ears, occasioned by the circumstance that the Eustachian tube does not allow the condensed air immediately to find its way into the cavities of the ear, so that the pressure on the outside of the tympanum is, for a time, unbalanced by a corresponding pressure from within, and occasions a sensation like that of having quills forced into the ears. This continues until the pressure of the air in the mouth, which at first has a tendency to keep the aperture of the Eustachian tube closed, forces it open; an action which is accompanied by a noise like a slight explosion. The condensed air then enters the interior cavities of the ear, and, by restoring the equilibrium of pressure on each side of the tympanum, removes the pain; which will return, and be remedied in the same manner, if the bell should descend to a greater depth. But while the mere condensation of the air in the bell does not render it unfit for respiration, it would soon become so if no means were provided for renewing it from time to time, as it becomes vitiated by repeated respiration. The improvements invented by Dr. Halley provided a remedy for this inconvenience, and for that of the contracted space left free from water, when, by being at a great depth, the air is compressed into a small volume, by affording a convenient means of supplying the bell with any required quantity of fresh air, without raising it to the surface.

The bell used by Dr. Halley was of wood, in the form of a truncated cone, five feet in diameter at the bottom, and three feet at the top, and containing about sixty cubic feet. This was coated with lead, and so weighted about the lower part that it would sink while empty, and would always remain in its proper position; that is, with the large open end downwards, with its rim parallel with the horizon. In the top of the bell was a very strong glass window, and a cock, by opening which the foul air might be allowed to escape. About a yard below the mouth of the bell was suspended a stage, so weighted that it might hang steadily. The whole apparatus was suspended from a sprit attached to the mast of a ship, and provided with tackle by which the bell might be raised or lowered, and the sprit might be slung round so as either to carry the bell over the hull of the vessel, or to suspend it clear of her side. The apparatus for conveying air to the diving-bell consisted of two barrels, holding thirty-six gallons each, weighted with lead to make them sink readily. Each of these had an open bung-hole in the lower end, to allow water to enter during their descent, so as to condense the air in the manner described when explaining the principles of the diving-bell itself. There was also a hole in the upper end of each, to which was fitted an air-tight leathern hose, long enough to fall below the bottom of the barrel, and having its loose end so weighted that it would fall naturally into that position. These air-barrels were attached to tackle, by which, with the easy labour of two men, they might be made to rise and fall alternately, like two buckets in a well; and, by lines attached to the lower edge of the bell, they were so guided in their descent that the mouth of the hose always came directly to the hand of a man who stood upon the stage suspended from it. As the apertures of the hose were, during their descent, always below the level of the barrels, no air could escape from them; but when they were turned up by the attendant, so as to be above the level of the water in the barrels, the air rushed out with great force into the bell, the barrels becoming at the same time full of water. By sending down these air-barrels in rapid succession, the air in the barrel was kept in so pure a state that five persons remained in the bell, at a depth of nine or ten fathoms, for more than an hour and a half at a time, without injurious consequences; and Halley states that he could have remained there as long as he pleased, for anything that appeared to the contrary. In addition to this, by the copious supply of air admitted during the descent, the bell was kept constantly full of air, and the water was prevented from entering to any inconvenient extent. Halley observed that it was necessary to be let down gradually at first, and to pause at the depth of about twelve feet, to drive out, by the admission of a supply of air, the water which had entered the bell. When the diving-bell was arrived at the required depth, he let out, by the cock in the top of the bell, a quantity of hot impure air, equal to the quantity of fresh air admitted from the barrels. This foul air rushed up from the valve with such force as to cover the surface of the sea with a white foam. So perfect was the action of this apparatus, that Halley says he could, by removing the hanging stage, lay the bottom of the sea so far dry, within the circuit of the bell, as not to be over shoes thereon. When the sea was clear, and especially when the sun shone, sufficient light was transmitted to allow a person in the bell to write or read: and when the sea was troubled and thick, which occasioned the bell to be as dark as night, a candle was burnt in it. Halley sometimes sent up orders with the empty air-barrels, writing them with an iron pen on plates of lead. Having, by these ingenious contrivances, removed the principal difficulties attending the use of the diving-bell, Halley foresaw its extensive utility. He observes, 'This I take to be an invention applicable to various uses, such as fishing for pearl, diving for coral, sponges, and the like, in far greater depths than has hitherto been thought possible. Also for the fitting and plaining of the foundations of moles, bridges, &c. upon rocky bottoms; and for the cleaning and scrubbing of ships' bottoms when foul, in calm weather at sea.' 'But,' he adds, 'as I have no experience of these matters, I leave them to those that please to try.' To several of these purposes the diving-bell has, since the date of this paper (1717), been applied with great advantage.

In 1732 a communication was made to the 'Philosophical Transactions,' No. 444, vol. xxxix., p. 377, by Martin Triewald, 'Captain of Mechanics, and military architect to his Swedish majesty,' respecting an improvement of the diving-bell. He had the sole privilege of diving upon the coasts of the Baltic belonging to the king of Sweden; and he expresses his opinion, founded on much experience, that no apparatus but that on the principle of the 'campana urinatoria,' or diving-bell, could be safely used at great depths. His letter mentions a man, then sixty-three years old, who had followed the business of diving with the common diving-bell ever since he was twenty. Triewald's diving-bell was of copper, tinned inside, smaller than that of Dr. Halley, and managed by two men. A stage for the diver to stand upon was suspended at such a depth below it, that the man's head would be but little above the level of the water, where the air is cooler and fitter for respiration than in the upper part of the bell; and a spiral tube was attached to the inside of the bell, with a wide aperture at the bottom, and a flexible tube and mouth-piece at the top, so that, when the diver was up in the bell, he might inhale cool air from the lower part, exhaling the foul air by his nostrils. Dr. Halley's air-barrels are applicable to a bell of this construction. In lieu of windows of flat glass, Triewald used convex lenses to admit light to the bell.

In 1775 Mr. Spalding, of Edinburgh (who, according to the 'Annual Register,' vol. xix., p. 202, was a grocer), having some concern in a vessel which had been lost on the Fern Islands, was induced to make some experiments with Dr. Halley's diving-bell, with a view to recovering property from wrecks, and was thereby led to the invention of means for rendering it more safe and manageable. For these inventions he received, in 1776, a reward of twenty guineas from the Society for the Encouragement of Arts, Manufactures, and Commerce, in the first volume of whose 'Transactions' (pp. 220-238) they are fully described. Mr. Spalding's communication contains also a very interesting account of his experiments with Halley's diving-bell. The improved diving-bell contrived by Mr. Spalding was made so light, that, with the divers and the weights attached to the rim, it would not sink; the weight necessary to counteract its buoyancy being added in the form of a large balance-weight, suspended from its centre by a long rope, which was so mounted on pulleys that the divers could either draw the balance-weight up to the mouth of the bell or allow it to fall to a considerable depth below it. Thus, by letting the weight down to the bottom, the divers could, as it were, anchor the bell at any required level; or prevent its further descent if they perceived a rock or part of a wreck beneath it, which might otherwise overturn it. Also, by hauling in the rope while the weight was at the bottom, the persons in the bell might lower themselves at pleasure. Another improvement consisted in the addition of a horizontal partition near the top of the bell, which divided off a chamber that might, by suitable openings and valves, be filled either with water, or with air from the lower part of the bell; so as to alter the specific gravity of the whole machine, and thereby to cause it to ascend or descend at pleasure. The bell was supplied with air by an apparatus resembling that of Dr. Halley; and ropes, stretched across

the bell, were used instead of seats and platforms for standing on. By these arrangements the persons in the diving-bell were enabled, in case of accident, to raise themselves to the surface without any assistance from above; and it was rendered so perfectly manageable, that it might be removed to a considerable distance from the point at which it descended; its outward motion, and its return to the vessel for the purpose of being hauled up, being assisted by a long-boat, which carried the signal-lines and the tackle for working the air-barrels.

Though not in chronological order, it may be well here to allude to an improvement upon Spalding's apparatus, contrived by Mr. John Farey, junior, and described by him in the article 'Diving-Bell,' in Brewster's 'Edinburgh Encyclopædia.' He proposes to make the upper chamber of the diving-bell very strong and air-tight, without any openings for the admission of water. In the partition are fixed two forcing-pumps, by which a portion of air should be forced into the upper chamber, whenever, during a pause in the descent, the lower chamber, or the cavity of the bell, is replenished with air. By this means the upper chamber is made a reservoir of condensed air, from which the bell may be replenished with air when it is desired to increase its buoyancy by forcing out the water from the lower part. In like manner, the buoyancy of the bell can be at any time diminished by pumping some of the air from it into the upper chamber, whereby the water will be allowed to enter to a greater height; and, as this is effected without wasting the air, there is no danger of diminishing the buoyancy of the machine to a degree which would prevent it from rising, in case the suspending rope or chain should break. Mr. Farey recommends the form of the frustrum of an elliptic cone, for diving-bells intended for descending to wrecks; the dimensions being, for a bell to hold two persons, six feet by four at the base, three feet six inches by two feet six inches at the top, and six feet six inches high. He also suggests the use of a pressure-gauge in the bell, to show the divers what depth they have descended to; and of a compass to enable them to ascertain and give proper signals respecting the direction in which the bell should be moved. These signals are given by snatching a rope, which may be marked in the same manner as a deep-sea lead-line [SOUNDINGS, vol. xxii., p. 269], so that, after giving a signal to raise or lower the bell, the diver may, by hauling in a certain quantity of the signal-line, intimate the height to which the bell should be moved. Farey recommends that the men be attached by ropes to the bell, so that, in case of falling, they may not sink; and that, in case of being obliged to leave a wreck to which it is intended again to dive, the balance-weight may be left at the bottom, with a buoy attached to the upper end of its rope, so that the right point for descending may be found without difficulty.

The credit of having been the first to apply the diving-bell in aid of civil engineering operations is usually attributed to Smeaton, who used it in 1779 in repairing the foundations of Hexham Bridge. The Report in which he recommended its adoption is a very interesting document, as it affords a familiar explanation of the principle of the diving-bell. It is dated September 16, 1778; and is printed in the collected edition of his 'Reports,' vol. iii., p. 279. The bell used on this occasion was an oblong box of wood, four feet high, two wide, and three and a half long; and it was supplied with air by a pump fixed on the top. The river being shallow, the bell was not covered with water; but in 1788 the diving-bell was used in a much more important work, Ramsgate harbour, by the same engineer. Being here used at a considerable depth, an apparatus was employed for forcing in a supply of air through a flexible pipe, by means of a forcing-pump in a boat. The bell used in this work was of cast-iron, similar in form to that employed at Hexham, but four feet and a half high, four and a half long, and three wide. Its weight was fifty cwt., and the thickness was so adjusted that it would, without the addition of any weights, sink in the proper position. 'In levelling foundations under water by this machine, the surface of the water at the bottom of the bell formed a convenient and unerring level to work to; and in this, as well as in the subsequent operation of building, every necessary motion was given to the bell by the tackle by which it was suspended; signals being made from below by striking one, two, three, or more blows upon the side of the bell with a hammer.

Since the time of Smeaton the diving-bell has been frequently, and with great advantage, employed in submarine works; sometimes in situations in which it would have been impossible to construct a coffer-dam, or to perform the required operations by any other means. The diving-bells used in such works are usually formed on the model of that made for the works at Ramsgate harbour; but the mode of suspension differs according to circumstances. The bell may be suspended over the side or end of a vessel; through an opening in the centre of a barge; from frame-work resting upon two barges, placed parallel with each other, but at such a distance apart as to allow the bell to descend between them, or from a scaffolding supported by piles. In operations at the harbour of Howth, near Dublin, the late Mr. Rennie used a diving-bell suspended from a kind of railway scaffolding like that described under SCAFFOLDING [vol. xx., p. 497], as used in erecting large stone buildings; two carriages being used upon the scaffold, one to lower the stones, and the other to manage the bell. By the apparatus described as above, aided by ropes attached to the stones, and managed by the men in the bell, the submarine masonry could be executed with great facility. Of the use of this important machine in recovering property from wrecks, the operations upon that of the Royal George afford a familiar example. According to the 'Annual Register,' vol. lix., p. 42, this wreck was first surveyed by the diving-bell on the 24th of May, 1817. Smeaton's method of supplying air to the bell is that most commonly employed; but that of Halley may, in some cases, have the advantage.

In whatever way a diving-bell may be mounted, it is essential that it should descend very gradually, and that its descent should be perfectly under control. In 1838, Mr. Richard Jones, who had been placed in a very perilous situation by the failure of the crab by which a diving-bell in which he was descending was being lowered, was rewarded by the Society of Arts for a contrivance to prevent the occurrence of such an accident. His improved crab has a brake, regulated by the centrifugal motion of two balls, like the governor of a steam-engine; so that, while the crab revolves slowly, and therefore allows the bell to descend gradually, the brake may not be called into action; but if it should, from any cause, be overpowered by the weight of the bell, so as to run down with dangerous velocity, the separation of the balls should disengage the brake, and thereby stop the motion of the crab. The machine is described and represented in detail in vol. lii., p. 72, &c. of the Society's 'Transactions.'

Blasting is often required in submarine operations, and is commonly performed by joining lengths of tin tube together, until they reach from the charge of powder to a little above the surface of the water. These lengths of pipe are joined either by screws or by a cement of white lead, so as to be water-tight, and as the joining is effected, the bell gradually rises, so that the top of the pipe is always under it, until it reaches the surface, to prevent water from getting in. When all arrangements are completed, a person in a boat drops a piece of red-hot iron down the tube, and thus fires the charge. The recently-invented plan of blasting by electro-magnetism is far simpler and more certain than the above.

Many plans have been proposed for enabling a man to walk beneath the surface of water, or to dive in such a manner as to assist in the raising of anchors, or the recovery of property from wrecks, by means of waterproof coverings for the head and upper part of the body, or of strong vessels in which every part but the arms should be encased; a supply of air being either transmitted from above by a flexible pipe, or contained in the cavities of the protecting armour. Such apparatus may be conveniently used at small depths; but at any considerable depth they are both dangerous and inconvenient, because the strength necessary to enable them to bear the pressure of the water is incompatible with the flexibility essential to the free use of the limbs. Dr. Halley alludes, in his paper on the diving-bell, to some contrivances of this kind; and in a subsequent paper (*Phil. Trans.*, No. 368, vol. xxxi., p. 177) he describes an apparatus of his own invention, by which a man might leave the diving-bell, and walk about at the bottom of the sea; his head being covered by a heavy leaden cap like a small diving-bell, supplied with air by a flexible tube extending from the large bell. The diver was to coil this tube round his arm, and unwind it as he left the bell; and to use it as a clue to direct him to the bell in returning. This pipe was formed of leather soaked in oil and hot wax, and was held open by a spiral coil of brass-wire; its internal

diameter being about one-sixth of an inch. The pipe was then covered with several thicknesses of gut, and over all with leather. The modern invention of water-proof India-rubber cloth, which has been applied in various ways to diving-apparatus, affords great facilities for the manufacture of water-tight tubes for such a purpose. So long as the helmet was above the level of the water in the bell, it would be kept full of air; and in case of having to stoop below that level, as in getting out of or into the bell, the diver had only to close a valve, by which the air in the helmet was prevented from returning into the bell. The front of the helmet was glazed; and the diver, who was clothed in a thick woollen dress, fitting close to the body, to diminish the effect of the coldness of the water, was enabled to walk by means of a weighted girdle and weighted clogs. Aquatic armour, whether supplied with air from above, or carrying a store in its cavities, sufficient to last for the time the diver intends to remain submerged, has been brought so little into use, that it is needless to devote the space required for a minute description. The apparatus of M. Klingert, which was first described in a pamphlet published at Breslau, in 1798, has been fully explained in Tilloch's 'Philosophical Magazine' (vol. iii., pp. 59 and 171), and in many other English works; and a more recent contrivance of similar character has been exhibited at the Polytechnic Institution, London. In the 'Gentleman's Magazine' for September, 1749 (vol. xix., p. 412), will be found a notice of a curious diving-apparatus, consisting of a case enclosing the person, with the arms protruding in flexible sleeves, which is stated to have been contrived and used for many years by a person named John Lethbridge, who writes from Newton Abbot, near Exon, Devon, and states that he tried experiments as early as 1715. This was supplied with air by flexible pipes. A similar machine was contrived by Mr. Rowe, in 1753, which was to be lowered by tackle like a diving-bell.

One of the diving-machines contrived by Klingert was so arranged that it would rise or fall by the motion of a piston in a cylinder, in the lower part of the apparatus, by which the diver could vary the density of the air, and consequently the specific gravity of the machine, at pleasure. A very simple apparatus for enabling a person diving without a bell, or any of the machines above noticed, to effect the same object, has been recently invented by Mr. W. H. Thornthwaite of Hoxton. It is described in the fifty-second volume (p. 243) of the 'Transactions' of the Society of Arts, by whom Mr. Thornthwaite was rewarded for it in 1839; and it consists of a hollow belt of India-rubber cloth, to which is attached a small but strong copper vessel. Into this vessel air is to be forced by a condensing-syringe, until it has a pressure of thirty or forty atmospheres. The belt is then put on, in a collapsed state, so that it affords no buoyancy, and does not impede the descent of the diver; but when he desires to rise, he opens a valve, by which the condensed air escapes from the copper vessel into the belt. As it expands the belt, it affords sufficient buoyancy to raise the diver immediately to the surface.

An account of schemes for submarine descent would hardly be complete without some allusion to projects for submarine navigation, of which many have been suggested. An early instance is that of Cornelius Drebell, or Drebelle, who is said to have made a vessel to be rowed under water, which was tried in the Thames by order of James I., and carried twelve rowers, besides passengers. This vessel is alluded to by Robert Boyle, in his 'New Experiments Physico-Mechanicall, touching the Spring of the Air, and its effects,' &c., published at Oxford in 1660. Pages 363-5 of this curious work contain an account of Drebell's experiment, and state that he accounted his chief secret to be 'the composition of a liquid that would speedily restore to the troubled air such a proportion of vital parts as would make it again, for a good while, fit for respiration.' The composition of this liquid for enabling the same air to be used again and again, was never made public. Bishop Wilkins, who also favoured some other whimsical projects, devoted a whole chapter of his 'Mathematicall Magick,' which was published in 1648, to a dissertation 'Concerning the possibility of framing an Ark for Submarine Navigation.' In this work (book ii., chap. 5) he recites the difficulties of the scheme, but evidently considers them not insurmountable; and afterwards he enlarges upon its advantages, in privacy, security from pirates, storms, ice, &c., in naval warfare, philosophical experiments, discoveries, &c., and at length states that 'All kind of arts and manufactures may be exercised in this vessel. The observations made by it, may bee both written and (if need were) printed here likewise. Severall Colonies may thus inhabit, having their children born and bred up without the knowledge of land, who could not chuse but be amazed with strange conceits upon the discovery of this upper world.' The bishop adds, 'I am not able to judge what other advantages there may be suggested, or whether experiment would fully answer to these notionall conjectures.' In 1774 a projector named Day lost his life in an experimental descent in Plymouth Sound, with a vessel of about fifty tons burden, which he thought he could have caused to rise after a lapse of several hours; and this experiment, of which an account is given in the seventeenth volume of the 'Annual Register' (p. 245), led to the publication, in the following year, of a 'Philosophical Dissertation on the Diving Vessel projected by Mr. Day, and sunk in Plymouth Sound,' by N. D. Falck, M.D., which contains a representation and minute description of the vessel, an account of the ineffectual attempts to raise her, and much other curious matter. One of the most successful machines contrived for submarine navigation was that of Mr. Bushnell of Connecticut, which was projected in 1771, and completed in 1775. Bushnell's chief object appears to have been the introduction of submarine warfare. His vessel, which was propelled by screws, somewhat resembling those recently tried for steam-vessels, is described in the 'Transactions' of the American Philosophical Society, vol. iv., p. 303, whence the account was copied into 'Nicholson's Journal,' vol. iv., p. 229. The more recent projects of Fulton for the same purpose have been referred to in a previous volume. [FULTON, ROBERT, vol. xi., p. 13.] In the article 'Diving-Bell,' in the *Encyclopædia Metropolitana*, written by Mr. Babbage, a detailed plan is laid down for the construction of a vessel for submarine navigation. Among the suggestions there made are those of using oxygen, condensed in store-vessels, to replenish the air, and of absorbing the carbonic acid produced by respiration, either by cream of lime, or by a strong solution of ammonia.

SUBMARINE FORESTS. Under this term geologists class very numerous accumulations of vegetable matter, involving roots, stems, branches, leaves, and fruits of trees, rarely in the attitude of growth, sometimes in the condition of having fallen, and locally with the appearance of having been drifted from some distance, but all occurring on the margin of the sea, below the level of high-water, and extending not unfrequently much beyond the low-water line.

Subterranean Forests is another term for similar phenomena, not limited however to any particular level, nor to a close proximity with the sea. The circumstances as to level, and physical condition of the neighbouring regions, when these buried forests either grew on or were drifted to their present repositories, and the changes in these respects which may have since occurred, are extremely worthy of consideration.

If we take, as a mode of classifying these phenomena, the relative levels of the buried forests and the surface of the sea, we find a series of instances, beginning on high ground, and ending below the sea. On parts of the very high ground at the head of Glencoe, we see yet rooted in peaty soil the bases of enormous trunks of trees, while far around, and even in much lower levels, and warmer and more sheltered situations, large trees are altogether wanting. On the moderate elevations between Kirby Lonsdale and Kendal are small dried basins of antient lakes, in which portions of fir-trees abound; on the course of many rivers, in flat parts of valleys, and especially when they approach the sea, as at Ferrybridge on the Aire, and at Stockton on the Tees, vegetable accumulations, peaty plants, and lacustrine shells, hazel-[illegible] nuts, and large trees abound. In situations where the sea ceases to have power, along the sides of rivers, the accumulations of this nature are locally enormous, as over the large level of Hatfield Chase and Thorn Waste in Yorkshire, Sedgemoor in Somersetshire, and the fens of Huntingdon and Cambridge. Finally, on reaching the actual sea-shore, whether along the course of a great river, as the Humber or the Mersey, or on the bare coast, as in Lincolnshire, Yorkshire, Norfolk, and many parts of the coast of Great Britain, we find narrow or extensive deposits of like nature, both above high-water and below low-water mark. Generally in all these

situations, the trees, even though not now growing in the neighbourhood, are of sorts that belong to the same latitude and the same region. What might be the circumstances which encouraged their growth in antient times is not easy to be determined. Instead of supposing any elevation of land since the growth of trees in the high valleys about Glencoe, which, by raising the surface to a temperature too low, prevented their continued existence, it appears better to suppose that the duration of forests under some constant conditions is limited. It is only by mutual protection in some cases that trees rise to perfection. Arriving from this cause nearly at once to maturity, and passing by equal stages to decay, it may easily happen, in a limited area, that a whole forest of trees should perish and be followed by no successors. Such an occurrence might be accidentally caused by the alteration of the supply of water, the growth of peat, addition of sediments, and other causes of injury. Violent tempests might prostrate a forest, and affect the drainage of the country, and thus convert the area where the forest grew into a marsh, a peat-bog, a buried forest.

Suppositions of this nature have commonly been suggested by the phænomena observed in various parts of Europe. De Luc adopts such views regarding the buried pine-forest of Bornholm, which is covered by peat and surrounded by sand-hills. The trees lie prostrated from the circumference toward the centre, not by the force of inundations, but by the violence of winds. (*Hist. de la Terre*, v. 222.) A similar opinion has been entertained concerning some part of the extensive levels of Hatfield Chase in Yorkshire, where in places the trees appear as if prostrated in a particular direction. Moreover, in examining the deposits of this nature on the shores of the Frith of Tay, Dr. Fleming found the clay below the peat penetrated by numerous roots which are either carbonized or pyritized.

But there are other cases in which the accumulations of buried timber and peat may better be supposed to have been drifted. This appears to be the fact in the eastward prolongation of the great levels of Hatfield Chase along the æstuary of the Humber, and much below its level. De Luc supposes the same thing in regard to the peaty deposit of Rotterdam, which rests on silt, as that reposes on sand. He regards the whole as drifted by the river currents, and as accumulated below the river waters.

There are many examples of the occurrence in one deposit of sand, clay, peat, timber, lacustrine shells, and bones of quadrupeds. It is rather characteristic of such combinations that there is only one layer of peat with trees, that it lies upon the clay, and that in this clay are the lacustrine shells and the bones of quadrupeds. This general rule applies to numerous small deposits on the coasts of Yorkshire and Lincolnshire, including bones of deer, and to the larger area of the Irish peat, which yield the bones of the gigantic elk; and is exemplified in the American deposits which contain the mastodon. Beneath the whole of these deposits frequently lie the gravelly clays and sands, with boulders of distant rocks, commonly called 'Diluvium.' The shells are usually of existing species, the trees of existing kinds, but the quadrupeds (beaver and Irish elk for instance) often of races locally or universally extinct.

It has been thought necessary in some cases to appeal to a local change of the relative level of land and sea for an explanation of the submerged forests of the English and European coasts: sometimes this may be avoided by assuming in antient times a different condition of the tides; and sometimes it is unnecessary, because the trees may be supposed to have been transported. It should seldom be granted, because, in the very same district, the 'diluvium' with its marine shells may be thought to be a 'raised beach,' and the submarine forests to mark a real subsidence of the land. This is the case in Holderness.

The antiquity of these buried forests is often beyond the
inference, but in many inland districts the con-
trees is such as to have led observers to
re *cut down* or *burned down*. In Hatfield
runs., 1701) many of the trees were thus de-
were evidently worked by the woodman's
wood. Roman coins were gathered from
nd in one situation the ground below
ploughed in ridge and furrow.
umulations such as have here been
ndant round all the shores of Britain,
interior of the islands.

(De la Beche, *Geological Manual*, 3rd edition, p. 166; Lyell, *Principles of Geology*; Phillips, *Treatise on Geology*, vol. ii.; De Luc, *Histoire de la Terre*; De la Pryme, in the *Philosophical Transactions*, abridged by Hutton; *Transactions of the Cornish Geolog. Society*, &c., may be consulted for details of phenomena and reasoning on the causes and dates of their occurrence.)

SUBMULTIPLE, an ALIQUOT PART.

SUBMYTILA'CEA, M. de Blainville's name for his sixth family of LAMELLIBRANCHIATA.

The following is his definition of the *Submytilacea*:—Mantle nearly as in the *Mytilacea*, that is to say, adherent, and slit throughout its lower part, with a distinct orifice for the anus and a commencement of a tube for respiration by means of a particular disposition of its posterior extremity, which is furnished with tentacular papillæ; a large fleshy abdominal mass for locomotion, without byssus at its base; two distinct muscular impressions.

Shell free, subnacreous, regular, equivalve; dorsal hinge lamellar, ligament external; two muscular impressions with the pallial impression which unites them not excavated backwards.

M. de Blainville remarks that this family are more or less inhabitants of mud, and are locomotive by means of their foot.

He divides them into two sections:—

1. The Limnoconchs (Limnoderma, Poli).

All these have an epidermis, are nacreous, and are inhabitants of fresh waters. [NAIADES.]

2.

Species without any evident epidermis, not nacreous, and more or less pectinated.

These are marine.

Under this section M. de Blainville arranges but one genus, *Cardita*.

Lamarck placed the genus *Cardita* in his family *Cardiacea*, between *Cardium* [CONCHACEA, vol. vii., p. 426] and *Cypricardia*. But M. Deshayes, in the last edition of the *Animaux sans Vertèbres*, well observes that this is not the true position of *Cardita*, as far as its approximation to *Cardium* is concerned, for the *Carditæ* have the lobes of the mantle disunited throughout their extent, whilst the other mollusks of the same family have these lobes united posteriorly and perforated with two apertures; and he observes that it will be right to follow the example of Cuvier and De Blainville, and to approximate the *Carditæ* to the *Unionidæ*, or fresh-water muscles. He remarks that Lamarck seems to believe that certain *Carditæ* have a byssus; but he adds that certain individuals checked in their growth, and so become irregular, have given rise to this opinion, which seems to him to be without foundation.

Generic Character.—*Animal* resembling that of the fresh-water muscles. [NAIADES.]

Shell very thick, solid, equivalve, often very inequilateral; umbones recurved forwards; hinge with two unequal oblique teeth, one short and cardinal, the other long, lamellar, bent, and placed much more backwards; ligament elongated, subexternal, and sunk into the shell; muscular impressions rather large and very distinct; pallial impression narrow.

M. de Blainville divides the genus into the following sections:—

A. Elongated species, a little notched or gaping at the inferior border; umbo nearly cephalic; ligament hidden. (The *Mytilicardia*.)

Examples, *Cardita crassicosta*, Adans., 'Seneg.,' pl. 15, f. 8; and *Cardita calyculata*, 'Malacol.,' pl. 69, fig. 1.

B. Oval species, with the inferior border nearly straight or a little convex, crenulated and completely closed. (The *Cardiocardita*.)

Example, *Cardita Ajar*. Adans., 'Seneg.,' pl. 16, f. 2.

C. Species nearly round or suborbicular, with the inferior border rounded, denticulated, and more and more equilateral; the two teeth shorter and more oblique. (Genus *Venericardia*, Lam.)

Example, *Venericardia imbricata*, 'Malacol.,' pl. 68, f. 3.

D. Elongated and very inequilateral species; the umbo nearly cephalic and recurved forwards; two short cardinal diverging teeth besides the lamellar teeth; ligament very long, little or not at all projecting; abdominal impression sometimes a little directed backwards. (Genus *Cypricardia*, Lam.)

M. Deshayes, in the last edition of Lamarck, observes

that the *Cypricardiæ* resemble the *Carditæ* in their form; but that, nevertheless, on a careful examination, one may perceive that they have more relationship to the *Cardia*: it is thus, he adds, that some species of the last genus lose the anterior lateral tooth; and others, instead of having the cardinal teeth *en croix*, have them nearly equal and diverging, as in the *Veneres*. If, says M. Deshayes, we unite the two modifications of *Cardia* in a single shell, we have a *Cypricardia*. On the other hand, the position of the muscular impressions, their extent, the pallial impression nearly simple or hardly sinuous posteriorly, and the great space which it leaves between itself and the border, lead M. Deshayes to suppose that the animal of *Cypricardia* has, as in *Cardium*, the lobes of the mantle united posteriorly and pierced in the commissure with two unequal apertures.

With regard to *Venericardia*, M. Deshayes (*loc. cit.*) is of opinion that it will be necessary to change the relationship of that genus, placed by Lamarck among the *Veneres*, and even to suppress it altogether, for the purpose of removing the species assembled under it to the genus *Cardita*. Many cogent reasons conducted M. Deshayes to this result. Poli, he remarks, has, in his great work, given figures of the animals of two species, one belonging to *Cardita*, the other to *Venericardia*. The resemblance of these animals in all essential characters proves satisfactorily that they appertain to the same genus, and this resemblance of the animals will be confirmed by that of the shells. We see, continues M. Deshayes, that Lamarck has comprised among his *Carditæ* elongated, transverse, very inequilateral shells, having at the hinge one or two very oblique teeth in the direction of the upper border. Doubtless if all the *Carditæ* were transverse, and the hinge presented some peculiar characters, it would have been reasonable enough to separate them, supposing the animals to be unknown; but this is not so, and Lamarck himself has arranged among the *Carditæ* rounded shells which have all the characters of *Venericardiæ*. In uniting all the species, living or fossil, of the two genera, and placing them in their most natural positions, a passage between them will be observed so insensible, says M. Deshayes, that it will be impossible to point out where *Venericardia* finishes and *Cardita* commences. When all the characters are examined, the same resemblance is observable as in the external forms. Nearly without exception, the *Venericardiæ* and *Carditæ* have longitudinal ribs, their shell is thick and solid, the lunule is small and much sunk, the hinge is more or less thick according to the species, and offers some modifications of small importance, according as the shell is rounded or transverse; these two teeth are oblique; and this obliquity is observable even in some species which are entirely transverse; but in the greater number of these last the anterior tooth becomes very small and perpendicular to the first: these differences are established by shades in passing from one species to the other. The pallial impression is always simple in its contour, and this important character is found in the *Venericardiæ* as well as in the *Carditæ*. It is necessary, M. Deshayes remarks, to remember here that in the *Conques* the pallial impression is never simple: posteriorly is seen a triangular inflexion, which announces that all the animals of that family are provided with two siphons posteriorly; the *Venericardiæ* and *Carditæ* have it not; the borders of the mantle are free throughout their extent, as in the *Naiades*. Up to this time naturalists have regarded as of great value the presence or absence of siphons, and the union or separation of the lobes of the mantle, and have advantageously employed these characters for the formation of families: if that of the *Conques*, to make it natural, ought not to contain any animals excepting those furnished with siphons posteriorly, and it is certain that such should be the rule, it becomes evident that *Venericardia* should be transported elsewhere; and as we have seen that it becomes fused as it were into *Cardita*, it ought to undergo the change of relationship necessary for that genus.

Habits of Cypricardia.—*Cypricardiæ* have been found on sands and reefs, but the depths do not appear to have been recorded.

Habits of Venericardia.—*Venericardia* has been found on mud and sands at depths varying from the surface to fifty fathoms.

Habits of Cardita.—*Cardita* has been taken on mud and sands, and sometimes attached to stones. Depths varying from the surface to thirteen fathoms.

M. Deshayes, in his Tables, makes the number of living species of *Venericardia* and *Cardita*, which he joins together, twenty-five: and he records *Carditæ Sulcata*, *Ajar*, *trapezia*, *squamosa*, *crassa*, and *intermedia*, as being found both living and fossil (tertiary). In the last edition of Lamarck, the only living species of *Venericardia* noticed is *Ven. australis*, from the seas of New Holland: of *Carditæ* twenty-one living species are recorded. To these must be added nine living species brought home from the coasts of Central America principally, by Mr. Cuming, and described by Mr. G. B. Sowerby and Mr. Broderip respectively in the 'Proceedings' of the Zoological Society of London, for 1832, and in Müller's 'Synopsis Testaceorum.'

Example, *Cardita calyculata*.

Description.—Shell oblong, white, painted with lunate brown spots; the ribs imbricato-squamous; the scales arched and incumbent.

a

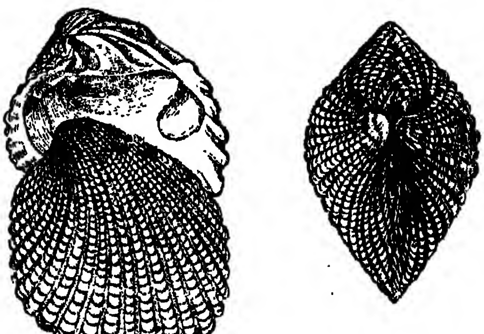
Cardita calyculata.

a, with the umbones turned towards the spectator sh… ; the hau…

Fossil Submytilacea.

With regard to the fresh-water division, see the article Naiades.

M. Deshayes, in his Tables, makes the number of fossil (tertiary) *Venericardiæ* and *Carditæ* fifty; the species found both living and fossil (tertiary) are noticed above. In the last edition of Lamarck the number of fossil *Venericardiæ* amounts to ten, and of *Carditæ* (fossil only) seven. Mr. Lea describes and figures four new species from the tertiary of Alabama. (*Contributions to Geology*.)



Venericardia (Cardita) imbricata.
Fossil from Grignon. A variety found at Courtagnon.

Dr. Mantell records *Venericardiæ planicosta* and *acuticosta* from the blue clay of Bracklesham, *Ven. Brongniarti* from the arenaceous limestone or sandstone of Bognor, a species from the chalk-marl, and a *Cardita?* from the firestone or upper green-sand. (*Organic Remains of the County of Sussex*.)

Professor Phillips records *Cardita similis* from the coralline and Bath oolite. (*Geology of Yorkshire*.)

Mr. Lonsdale notices a *Cardita* from the inferior oolite. (*Oolitic District of Bath*.)

Professor Sedgwick and Mr. Murchison mention a *Venericardia* from the Gosau deposit and its equivalents in the Alps; and a *Cardita* or *Venericardia* among the fossils of Lower Styria. (*Structure of the Eastern Alps*.)

Dr. Fitton records *Venericardia tenuicosta* from the gault (Kent, S. Wilts). (*Strata below the Chalk*.)

Mr. Murchison enumerates six species, all named, of *Cypricardia?* from the Silurian rocks—old red-sandstone (middle and lower beds only), upper Ludlow rock, Aymestry limestone, and lower Ludlow rock. (*Silurian System*.)

SUBORNATION OF PERJURY. [Perjury.]

SUBOSTRA'CEA, M. de Blainville's name for his second family of Lamellibranchiata.

Family Character.—Mantle open nearly throughout its circumference, retractile at all points, and not adherent; branchiæ not united throughout the median line, so as to

expose the abdomen, which is provided with the rudiment of a foot often canaliculated, with the rudiment of a byssus.

Shell of a close texture, subsymmetrical, always more or less auriculated, with a subcomplicated hinge; a single subcentral muscular impression, without any trace of the pallial ligula.

Genera.—*Spondylus, Hinnites, Pecten, Pedum, Lima.* [PECTINIDÆ; SPONDYLIDÆ.]

SUBPŒNA. [WITNESS.]

SUBPŒNA, WRIT OF. [PLEADING IN EQUITY; RICHARD II.]

SUBSALT. [SALTS.]

SUBSIDIARY. A quantity or symbol is so called when it is not essentially a part of a problem, but is introduced to help in the solution. The term is particularly applied to angles, since the trigonometrical tables give a great power over their management, which causes their frequent introduction, even in problems in which there is no question of angular quantity. For example, suppose it required to calculate $ax + b\sqrt{(1 - x^2)}$, where $a = \cdot 29164$, $b = 3\cdot 0018$, $x = \cdot 11316$. Assume $x = \cos\theta$, $a = r\cos\phi$, $b = r\sin\phi$, which gives θ from the tables, and ϕ and r from the tables, and from

$$\tan\phi = \frac{b}{a},\ r = \frac{a}{\cos\phi}.$$

The quantity to be calculated is

$$r\cos\phi\cos\theta + r\sin\phi\sin\theta, \text{ or } r\cos(\phi-\theta),$$

$$\text{or} \quad \frac{a\cos(\phi-\theta)}{\cos\phi},$$

and the final result is found from the tables in much less time than $ax + b\sqrt{(1-x^2)}$ could be calculated by ordinary means. There is of course no rule for the most convenient introduction of subsidiary angles: every case must be treated according to the circumstances it presents.

SUBSIDY, from *subsidium*, a Latin word signifying aid or assistance. 'Subsidies,' says Lord Coke, 'were antiently called auxilia, aides, granted by act of parliament upon need and necessity; as also for that originally and principally they were granted for the defence of the realm and the safe keeping of the seas,' &c. The word used in its general sense was applied to aids of every description; these were of two kinds, one perpetual, the other temporary. Those which were perpetual were the antient or grand customs, the new or petty customs, and the custom on broadcloth. The temporary included tonnage and poundage; a rate of four shillings in the pound on lands, and two shillings and eight pence on goods; and the fifteenths or tenths, &c. of moveable goods. The limited sense, which is also the more common sense, of the word subsidy, attaches only to the rate on lands and goods.

The grand customs were duties paid on the exportation of wool, sheepskins, and leather, at the rate of, for every sack of wool weighing thirty-six stone, half a mark, or six shillings and eightpence; for every three hundred sheepskins, half a mark; for a last of leather, a mark, or thirteen shillings and fourpence. The petty customs were payable by merchant strangers only, and consisted of an excess of one half over and above the grand customs payable by native merchants. The custom on broadcloth was first given to the king in the 21st year of Edw. III., to indemnify him for the loss he incurred in consequence of the practice, then beginning to prevail, of making up the wool into cloth in this country previous to its exportation. The rate of payment on broadcloths was fixed, in the 27 Edw. III., for every whole piece of cloth not ingrained, at fourpence; ingrained, at fivepence; if dyed scarlet, at sixpence. In addition to this was the alnager's fee, payable also to the crown, for measuring the cloth, at the rate of a halfpenny a cloth. There were also two species of customs payable on wines: one called butlerage, payable by foreigners importing wines, at the rate of two shillings for every tun of wine; the other, called prisage, payable by natives at the rate of, for every vessel importing ten tuns of wine, one tun; for every vessel importing twenty or upwards, two tuns; taken one tun from before, the other from behind the mast. This was compounded for by the payment of 20*s*. for each tun to which the king was entitled.

The origin of these customs seems uncertain; Lord Coke is very anxious to establish that they were in the first instance established by the common consent of the realm in parliament assembled. In support of this he cites Philip de Comines (lib. v., fo. 233): 'Reges Angliæ nihil tale, nis convocatis primis ordinibus, et assentiente populo, suscipiunt. Quæ consuetudo valde mihi laudanda videtur; interveniente enim populi voluntate et assensu crescit robur et potentia regum, et major est ipsorum auctoritas et feliciores progressus' (The kings of England take nothing of this kind unless the nobles are convoked and the people assent: which practice seems to me most laudable, for by the intervention of the free will and assent of the people the strength and power of kings becomes greater and their proceedings more fortunate). Comines however is speaking after various acts had passed restraining the king from taking customs without the assent of parliament. Coke also at great length inquires into the earliest parliamentary records in support of the same opinion. Every one however of those seems to show the existence of something payable as a custom anterior to any parliamentary grant. In the earliest statutes the customs are called custumae antiquae, and custumae ex antiquo.

Before and during Lord Coke's time, as well as immediately after it, the origin and nature of this kind of subsidy were most fully and ably discussed. To understand the subject it is necessary to advert to the sources of revenue possessed by the early Norman kings of England. These kings themselves held a large portion of the lands of the country. Some of these were occupied by villeins, which were taxable by their lord at his pleasure. Others were held by tenants in antient demesne, who originally were bound to perform services of an ignoble kind, such as manuring the lord's land, &c., which services were afterwards commuted for rent. The tenants in burgage, who held lands, &c. in royal cities and boroughs, were also taxable without their consent in parliament, but not, as was said, except upon extraordinary occasions. Lastly there were the tenants holding immediately of the king, who were bound to perform various feudal services. From these last tenants great profits arose to the king by escheats, relief, wardships, marriages, &c. The king also had a right to require contributions from the inhabitants of particular districts towards the expense of repairing bridges and the walls of towns, which contributions were called pontage and murage; and to grant by charter to any city the right to levy tolls upon all vendible things coming into the town. There were also other sources of revenue, the temporalities of vacant bishoprics, the forfeitures arising from felonies, &c. In the earlier periods these seem to have been considered sufficient to maintain the royal state, the courts of justice, &c., and also the ordinary expenses of any wars in which the king might be engaged. In the sixth year of Richard II., the commons petitioned the king that he would live upon his own revenues, and that wards, marriages, releases, escheats, forfeitures, and other profits of the crown might be kept to be spent upon the wars for the defence of the kingdom. In addition however to those duties of defending the kingdom by foreign wars, the king was bound to protect the merchants at sea from pirates, &c., and for this purpose a practice prevailed twice in the year 'to scour the narrow seas.' To defray the expenses of the royal navy, the king collected at the ports of his kingdom certain sums upon all merchandise imported or exported. These sums were called customs, a word which in itself indicates the earliness and uncertainty of their origin. 'To say the truth,' says Mr. Hakewell, in his able argument during the parliamentary discussion relative to Bate's case in the time of James I., 'all these things began, no man can say certainly when or how, but by a tacit consent of king and people and the long approbation of time beyond the memory of any man.' It is to be observed that Hakewell is arguing *against* the existence of a royal prerogative to lay fresh impositions. The right to collect some sum seems however to have existed from the earliest times, and the only limitation in amount seems to have been that the sum should be a reasonable one, regard being had to the purpose for which it was collected. In process of time however, the ordinary sources of the king's revenue being continually diminished by the alienation of crown lands, &c., while the expenses of the crown were increased, the kings imposed of their own authority such sums as varied from the original amount collected, and were complained of as unreasonable by the people. The earlier parliamentary history is full of remonstrances and petitions against grievous and unaccustomed impositions, maltolts (evil tolls), &c. There was an instance also of a petition by the merchants that they might pay no toll, but be allowed to protect their ships themselves. Ultimately the kings were driven by their necessities, the difficulties of the collection of irregular duties,

and the circumstances of their position, to have recourse to parliament to fix and authorise the sums to be collected as customs. The first statute on the subject occurs in the third year of the reign of Edward I., when the antient or grand customs were fixed at the sums already stated.

It is observable that in no instance was the right of the king to collect some duties disputed; all that is complained of is the excess and unreasonableness of the sum recently imposed. Many statutes occur on the subject, in which the king often—when the supply is needed, for instance, 23 Ed. I., as a provision against the French, who it is said intended altogether to wipe out (omnino delere) the English language—undertakes that the amount shall be properly applied, and that no aid shall be raised for the future except by consent of parliament. These promises, like the provisions of Magna Charta, which was renewed or confirmed thirty-one times, were generally broken, especially up to the end of the reign of Richard II. However, they were so often repeated, that at last they seem to have acquired some degree of validity, till they were again infringed in a few instances in the reigns of Elizabeth, Mary, and the Stuarts. In these later times however, such infringements were not passed over lightly. In the reign of James I. the question as to the right of the king to increase the customs upon merchandise, without assent of parliament, was raised on the occasion of his imposing five shillings per cwt. on currants. The court of exchequer decided that the king had such right, on the grounds, 1st, that his extraordinary and absolute prerogative was not bound by the statutes restaining him from increasing the customs without assent in parliament; 2nd, because the extra duty 'was not a burden to the commonwealth, but to delicate mouths.' This decision however raised great discussion in parliament, who pronounced it to be illegal. The writs for ship-money in the time of Charles I. created a similar ferment, and notwithstanding the petition of rights, the question cannot be said to have been entirely set at rest till up to the period of the Revolution.

The petty customs were originally founded on a bargain between the foreign merchants and king Edward I., by which they agreed to pay him the amount of them, in consideration of certain privileges granted them, and a release to them of all other prises and takings. Butlerage has the same origin, but is perhaps of an earlier date. Prisage is stated by Lord Coke himself to be due to the king by prescription, and the right of the king to it seems to have stood upon that alone; that right must have been one of inheritance, since by royal charters it was granted to the city of London and to the Cinque Ports for ever.

Tunnage and poundage was a duty varying in amount at different times from one shilling and sixpence to three shillings upon every tun of wine, and from sixpence to a shilling upon every pound of merchandise coming into the kingdom. The object in granting it was said to be, that the king might have money ready in case of a sudden occasion demanding it for the defence of the realm or the guarding of the sea. This kind of subsidy appears to have had a parliamentary origin. The earliest statute mentioned by Lord Coke as having granted it is 47 Ed. III. In the early instances it was granted for limited periods, and express provision was made that it should have intermission, and vary, lest the king should claim it as his duties. It was generally granted upon condition, or for a consideration expressed, as for the keeping and safeguard of the seas, &c., and in some instances the persons assigned to receive it showed particulars to prove that it had been properly expended about the salvation and defence of the kingdom. The duties of tunnage and poundage were granted to Henry V. for his life, with a proviso that it should not be drawn into a precedent for the future. However, notwithstanding the proviso, it was never afterwards granted to any king for a less period. These duties were farmed while Lord Coke was commissioner of the treasury, for 160,000*l.* a year. In the course of the argument in the case of ship-money in 13 Charles I., the king's duties are said to amount to 300,000*l.* This probably was the aggregate of the customs and tunnage and prisage.

Subsidy in its more usual and limited sense consisted of a rate of 4*s.* in the pound on lands, and 2*s.* 8*d.* on goods, and double upon the goods of aliens. The taxes called tenths, fifteenths, were the tenth or fifteenth part of the value of moveable goods. Other portions, such as the fifth, eighth, eleventh part, were sometimes, but rarely, also levied. These taxes seem to have had a parliamentary origin. There are no appearances of the king ever having attempted to collect them as of right. Henry III. received a fifteenth in return for granting Magna Charta and the Charta de Foresta. In the earlier periods never more than one subsidy and two fifteenths were granted. About the time of the expectation of the Armada (31 Eliz.), a double subsidy and four fifteenths were granted. The then chancellor of the exchequer, Sir Walter Mildmay, when moving for it, said, 'his heart did quake to move it, not knowing the inconvenience that should grow upon it.' The inconvenience did grow very fast, for treble and quadruple subsidies and six fifteenths were granted in the same reign. These grants seem to have been at intervals of about four years at that period. Subsidies and fifteenths were originally assessed upon each individual, but subsequently to the 8 Edward III., when a taxation was made upon all the towns, cities, and boroughs, by commissioners, the fifteenth became a sum certain, being the fifteenth part of their then existing value. After the fifteenth was granted by parliament, the inhabitants rated themselves. The subsidy, never having been thus fixed, continued uncertain, and was levied upon each person in respect of his lands and goods. But it appears that a person paid only in the county in which he lived, even though he possessed property in other counties. And, as Hume observes, probably where a man's property increased he paid no more, though where it was diminished he paid less. Certain it is that the subsidy continually decreased in amount. In the eighth year of the reign of Elizabeth it amounted to 120,000*l.*, in the 40th to 78,000*l.* only. Lord Coke estimates a subsidy (probably in the reign of James I. or Charles I.) at 70,000*l.*; the subsidy raised by the clergy, which was distinct from that of the laity, at 20,000*l.*; a fifteenth at about 29,000*l.* Eventually the subsidy was abolished, and a land tax substituted for it.

(2 *Inst.*; 4 *Inst*; 'Bate's Case,' &c., 2 *State Trials*, 371, ed. 1809; 'The Case of Ship Money,' 3 *State Trials*, 826, ed. 1809; Venn's *Abrt.*, tit. 'Prerogative;' Comyn's *Dig.*, tit. 'Parliament,' 'Prerogative.') [CUSTOMS.]

SUBSTANCE. In general usage Substance means a solid. In philosophical speculations it has undergone the fate of most general terms, and has been tortured into all possible shades of meaning. In physical speculations it has usually been taken as an equivalent to matter; but in metaphysical speculations its meaning, as sanctioned by the highest authorities, has remained true to its etymon (*substans*, that which *stands under* phenomena). This meaning will be rendered intelligible by the notion of some Hindu philosophers, who supposed the world to rest on the back of an elephant, and that the elephant stood on the back of a tortoise; what supported the tortoise, they omitted to explain. In adopting their theory, we may add that *that* which the tortoise stood upon was substance.

As we know that all phenomena must depend upon noumena, of which they are only the manifestation; or, to use the language of the schoolmen, as all accidents must be accidents of *something*, and must depend on that something for their existence, so in pushing our analysis to its limit, we must finally arrive at a point to which we can give no antecedent, which we are forced to assume as final, and as standing under or supporting the whole, and this we call Substance. It is the fundamental fact of all existence. We can never know it, for we know only phenomena, which are its appearances. We can never conceive it, for the first attempt to conceive it brings it within the sphere of our ideas, which are only those of phenomena. We can never imagine it, but we are compelled to assume it. It is to us a logical fact, not a noumenal one. Necessary as the basis of all speculation, as the 'point' in mathematics, but, like the point, for ever a mere logical distinction. It is needful for all men to know that this substance is, with respect to the mind, a merely logical distinction from its attributes; and it is needful also to know that as the mind can never transcend the sphere of its action, and consequently never know more than the attributes, all that it can predicate of substance must be false, for substance is to it a mere negation; if it would affirm anything of substance, it must inevitably affirm it by its attributes, which it alone can know positively.

It is from inattention to this latter fact that metaphysicians have blundered and misunderstood each other so constantly. You cannot conceive a point which has neither length nor breadth; you must assume it. You cannot

conceive substance shorn of its attributes, because those attributes are the sole staple of your conceptions; but you must assume it. Analyse as you will, you can never get beyond a vague and negative conception of a certain substratum, which, whenever you attempt to realise it, you must invest with attributes. Glass is a substance, at least is called so in common language. Analyse it, and you find that it is no substance—that it is merely the co-existence of flint and alkali. Your substance then has vanished with the analysis. It was found to be flint *and* alkali, nothing more; no distinct element, no *substratum* was discovered. Where then was your glass substance? The glass was a mere mode of existence of two particles of flint and alkali; it was in itself nothing, it had no existence apart from those particles, it had no *substratum*. Analyse the flint in the same way, and you will find the flint to be in itself no substance, but a mode of existence of some other particles. And yet the mind refuses to admit that this analysis could be so continued ad infinitum, thus reducing everything to mere phenomena; it is impelled to stop somewhere, and to ask, 'attributes of what?' and there where it stops it recognises substance. Hence Spinoza's definition of substance being existence itself.

Fichte, the most scientific expositor of idealism, has denied all substance except that of the Ego, and he says, 'Attributes synthetically united give substance, and substance analysed gives but attributes; a continued substratum, a supporter of attributes is an impossible conception.' (*Wissenschaftslehre*, p. 145.) Granted an impossible conception, but not therefore an impossible fact. Fichte assumes that the subjective conception—the idea—is the complete correlation and adequate comprehension of the whole objective fact; and if this point be admitted, his system is irrefutable, for attributes being obviously mental conditions, and as beyond them we are conscious of nothing, so nothing but what they affirm can exist. Interrogate consciousness, and you will get no answer that will apply to a substance. It knows only attributes. Matter is extended, coloured, and of a certain weight. Yet philosophy has long established that weight and colour are purely mental conditions—are effects produced by matter on the sensorium, not qualities of matter in themselves; and Kant has irrefragably shown extension to be the form imprinted on all objects by our minds; and even disputing this, there is no dispute that extension *quâ* extension is not matter, and that colour *quâ* colour is not matter, but that matter is *something* extended and coloured. No, replies Fichte, it is but the synthesis of these attributes, as glass was the synthesis of flint and alkali; and on the Ideal theory, there can be no question of his being correct.

If we dissent from these conclusions, and maintain that there is substance apart from its attributes (though we insist on this distinction being purely logical), it is because the Idealists have not proved the fundamental position on which all such speculation rests, namely, the truth of the correlation between the conception and the object, so that the one should be taken as the entire expression of the other.

In our analysis of substance it is impossible to get beyond attributes; and therefore, subjectively speaking, substance is nothing more than the synthesis of attributes: but does this entitle us to assume that it is equally the case objectively? Not until the subject has been proved to be the complete expression of the object.

But the truth is, attributes themselves are but the conditions excited in us by objects. The Ego acted on by the non-Ego undergoes certain affections: these mental affections are variously extension, colour, weight, hardness, &c., and these are all the effects of the action of the non-Ego upon the Ego, and as a consequence these are all we know, and all we know of the non-Ego. To call substance therefore the synthesis of attributes, is to say that in the synthesis of our mental affections is contained all that *constitutes* the non-Ego, instead of saying that in the synthesis of our mental affections is contained all we can positively *know* of the non-Ego; it is saying that we include all existence, and that fround our conceptions nothing exists; it is taking the hu-paymaind as the measure of the universe.
titled. maintain therefore, that inasmuch as what we call
Thutes are not vague abstractions, but positive effects of is vier acting on the sensory (and we assume the existence stamatter because Idealism has failed in disproving it); so parb must be substance or cause to produce those effects; Com lthough we can only know these effects and *by* these effects, yet we are necessitated to assume an inconceivable cause or substance. We do not know this substance: we only know what it excites in us, as a man in the dark receiving a blow from a bludgeon knows only his individual sensation received from that unknown something; it may be a stick, the butt-end of a gun, or a hammer: he knows nothing of what its nature may be; all he knows is what sensations it excites in him.

The stronghold of Idealism is consciousness. In consciousness there is nothing but transformations of itself—no substance, no external world is given; it knows, it feels, it is conscious of nothing but itself. But consciousness is equally the stronghold of Realism; for we are as conscious that what we call substance, or the world, is not ourselves, and does not depend upon us, and is a distinct existence, as we are of our own existence. Hence the universality of the belief of an external world—hence the impossibility of the Idealists' conceiving for an instant the non-existence of substance.

In conclusion we may observe, that substance is the unknown, unknowable substratum on which rests all that we experience of the external world: it is the hidden noumenon whose manifestations as represented in perception we call matter and the phenomena of matter, and of which every positive predicate must necessarily be false, and consequently all inquiry into its nature baseless.

SUBSTITUTION, a very common algebraical process, being, as its name imports, the substituting for any quantity another which is equal to it.

A method of approximation, which is frequently used and of great importance, has obtained the name of *successive substitution*. Let any equation be reduced to the form

$$x = a + e\phi x,$$

where e is less than unity, and ϕx a function of x. If we make $x=a$, the error thereby committed is less than ϕx, being $e\phi x$, in which e is less than unity. Take this value $x=a$, and substitute it on the second side, giving $x=a+e\phi a$: this value is nearer than the last in most cases, for it should be

$$x = a + e\phi\,(a + e\phi x)$$
$$= a + e\phi a + e^2\phi' a.\ \phi x \text{ nearly,}$$

where $\phi' a$ is the differential coefficient of ϕa. The last error was $e\phi x$, and the present error is less, if $e\phi' a$ be less than unity. Generally, if for x we write $a+p$, and if p be erroneous by a quantity of the order e^n, we shall have, by one more substitution,

$$x = a + e\phi\,(a+p).$$

Now the error of $\phi\,(a+p)$ will be of the order e^n, and that of $e\phi\,(a+p)$ of the order e^{n+1}. There is then a continual approximation to the value of x.

Beginning with $x=a+e\phi a$, in which the error is of the order e^2, we have

$$x = a + e\phi\,(a + e\phi a),$$

in which the error is of the third order. Rejecting terms of the third order, we have

$$x = a + e\phi a + e^2\phi a\,\phi' a.$$

Substitute this again, and we have

$$x = a + e\phi\,\{a + e\phi a + e^2\phi a\,\phi' a\},$$

in which the error is of the fourth order. Rejecting terms of the fourth order,

$$x = a + e\phi a + e^2\phi a\,\phi' a + e^3\left\{ (\phi' a)^2\phi a + \frac{\phi'' a}{2}(\phi a)^2 \right\}$$

and so on: the developments being made by TAYLOR'S THEOREM. This would lead in effect to the celebrated theorem of Lagrange: but the actual method of substitution is sometimes preferable.

SUBTANGENT, SUBNORMAL. [TANGENT.]

SUBTENSE, means any line, angle, &c. opposite to or *subtending* a line or angle spoken of. Thus the chord of a circle is the subtense of the arc and of the angle at the centre. The term is now not much used.

SUBTERRANEAN FORESTS. [SUBMARINE FORESTS.]

SUBTRACTION, SUBTRAHEND, MINUEND. The process of subtraction is the removal of a part equal to the less from the greater. The quantity to be diminished (*minuendum*) was called the *minuend*; the quantity to be withdrawn (*subtrahendum*) the *subtrahend*; and the remaining part the *remainder*. The terms subtrahend and minuend are almost out of use, though often very convenient.

The operation of subtraction is often described in a way which might be practised, but is not; and the explanation of the possible mode applied to the actual mode makes confusion. It is obvious enough that if parts of A be subtracted severally from greater parts of B, the remainders put together make up the whole remainder. Thus 24 can easily be taken from 76, for 7 tens exceeds 2 tens by 5 tens, and 6 exceeds 4 by 2, so that 52 is the remainder required. But when we come to take 48 from 93, the preceding mode of partition is useless. To remedy this it is proposed in the explanation to *borrow* one of the nine tens in 94, and to put it on to the 4: then 8 from 13 leaves 5. Now take the four tens of 48, and subtract from the *remaining* 8 tens of 93, and 4 tens are left: the answer then is 45. The process would be as follows:—

93	8 from 3, impossible: borrow a ten from 90; 8 from
48	13 leaves 5. Take 4 tens from the remaining 8
—	tens, one of the nine tens having been borrowed,
45	and 4 tens remain.

This process is actually used on the Continent, but with us, as all the world knows, there is a different process, as follows:—

93	8 from 3, impossible: take 8 from 13, and 5 remains.
48	*Carry** one to 4, giving 5, and subtract 5 tens from
—	9 tens, giving 4 tens.
45	

There is quite a different principle in this process, which is as follows:—If two numbers be equally increased or equally diminished, the difference remains the same. Having arbitrarily increased the three in the upper line by ten, the lower line must be somewhere or other increased by ten, in order to keep the difference (which is all that is wanted) unaltered.

The object in view is attained by increasing the upper line by ten *units*, and the lower line by one *ten*.

We are inclined to think that in the actual performance of subtraction it would be better than the mode usually employed, if we added in thought to the lower to make the higher, instead of passing from the higher to the lower by mental subtraction. Thus the details of the following question are written down, the words in Italics being made emphatic, and the figures written down at the moment they are repeated or thought of:—

```
4794236
 887349
-------
3906887
```

Nine *and seven* are sixteen (some persons would here take the trouble to say, carry one, one and four are five: but in this method, if the last-named word be ten or more, it is a direction to increase the next figure by one). Five *and eight* are thirteen: four *and eight* are twelve: eight *and six* are fourteen: nine *and nought*† are nine: eight *and nine* are seventeen: one *and three* are four.

This mode would render easy the compendious manner in which the operation of division, extraction of the square root, &c. are performed by some of the continental nations, in which the multiplication and the subtraction by which it is followed are performed at one step: thus—

```
12439729 ) 43874924183 ( 3527
            65557371
             33587268
              87078103
              00000000
```

The first step is to multiply 12439729 by 3, and to take the result from 43874924; the subtraction is performed by passing to the proper unit in the same decad or that next above, and carrying the tens' figure of the decad last employed. The proceeds of the multiplication table are put down without statement, and the computer should learn to remember products without the necessity of repeating '6 times 5 is 30,' '7 times 7 is 49,' &c.

27 *and seven* are 34: 6 and 3 are 9 *and three* are 12: 21 and 1 are 22 *and seven* are 29: 27 and 2 are 29 *and five* are 34: 9 and 3 are 12 *and five* are 17: 12 and 1 are 13 *and five* are 18: 6 and 1 are 7 *and six* are 13: 3 and 1 are 4 *and nought* are 4. The remaining steps are done in the same way. A person not used to this method will hardly believe at first how easily it is acquired, and how much trouble it saves. Those foreigners who are brought up in it find our method perplexing, and liable to lead to error, and greatly prefer their own—we think, with reason.

* The student may well ask *from where?* The term 'carry' is not the proper one.

† Beginners in arithmetic (and older persons too) frequently think this word is *ought*; but *ought* is anything, and *nought* is nothing.

SUBULICORNES (Latreille), a section of Neuropterous insects containing the dragon-flies (*Libellula*, Linn.) and the Ephemeræ. The larvæ of these insects are carnivorous, and live in the water, respiring by means of appendages situated on the sides or extremity of the body; the pupæ also live in the water, but leave that element to undergo the final transformation. In the perfect insect the wings are always reticulated, and when at rest are in some species horizontal, in others vertical; the compound eyes are very large and prominent; and the ocelli, or simple eyes, are two or three in number; the mandibles and maxillæ are covered by the labrum and labium; the antennæ are short, slender, and subulate.

The dragon-flies (*Libellulidæ*) have the four wings of equal length, the tarsi three-jointed, the antennæ very small and resembling minute bristles, the eyes extremely large, and generally approximated above; the fore part of the head, or what might be termed the face, has an inflated appearance; the legs are rather small, and the abdomen is elongated, sometimes cylindrical, and sometimes depressed, and terminated by membranous appendages. The larvæ and pupæ, both of which are active, nearly resemble the perfect insect in general form, and are remarkable for the great development of the labial apparatus, which is elongated and dilated at the extremity, and covers the fore part of the head like a mask.

The *Libellulæ* are divided into three genera by Fabricius. Those species which have the wings extended horizontally when at rest, the head almost globular, the eyes very large and meeting on the vertex, an elevation in front and close to the eyes, and the abdomen depressed, form the genus *Libellula* as restricted by that author.

The second genus (*Æshna*, Fab.) is chiefly distinguished by the cylindrical form of the abdomen and its greater proportionate length. The wings are as in *Libellula*, and the head is of the same globular form.

In the third genus (*Agrion*, Fab.) the wings when at rest are elevated perpendicularly; the head is transverse, and the eyes are widely separated. Examples of each of these genera are found in this country.

The second division of the *Subulicornes*, or the family *Ephemeridæ*, is distinguished from the *Libellulidæ* by the comparative softness of the parts of the mouth, they being of a membranous character in the insects of the present family, and the parts less defined; the tarsi are five-jointed; the inferior wings are much smaller than the upper, and in some are absent; the abdomen is terminated by two or three long and hair-like appendages. They form the genus *Ephemera*, according to Linnæus, and were so called on account of their short term of life, that is, in the imago or perfect state.

The Ephemeræ, or May-flies, Latreille states, usually appear at sunset, in fine weather in summer and autumn, on the banks of rivers, lakes, &c., and sometimes in such remarkable numbers, that after their death the surface of the ground is completely covered with them, and in certain districts on the Continent they have been collected in cart-loads for manure.

These insects collect together in great numbers in the air, and fly in an undulating manner, constantly ascending and descending, and have a very beautiful appearance. The males are distinguished from the females by the abdomen being furnished with two articulated hooks at the extremity, and apparently the anterior legs and the terminal filaments of the abdomen are larger in this sex; the eyes are also larger. In some there are four compound eyes, two of which are elevated and larger than the others.

The female insect deposits her eggs in the water, and these are collected together in a mass, after which it ...ses which it ...ey the duration of life in the perfect state b...arkable fact, that both sexes. When however we trace ...ost variable forms, transformations, we find their existence ...formation in all the one, for in the larva and pupa state som... the young *Bran*-two or three years. During this time ...nce it is even im-hidden, at least in the day-time, in th... of *Cyclops*. stones; sometimes in horizontal holes ...subclass divides rivers.

SUCCESSIVE SUBSTITUTION. [SUBSTITUTION.]

SUCCINAMIDE. When dry succinic acid is acted upon by ammonia, water is given off with the evolution of heat, and a fusible crystallizable *amide* is formed, soluble in water and in alcohol.

According to D'Arcet, it consists of nearly—

Eight equivalents of carbon . .	48
Five equivalents of hydrogen . .	5
Four equivalents of oxygen . .	32
One equivalent of azote . .	14
	—
Equivalent . .	99

When crystallized, it contains two equivalents of water 18; its equivalent is then 117.

SUCCI'NEA, M. Draparnaud's name for a genus of pulmoniferous gastropods belonging to the *Colimacea* of Lamarck and the *Limacinea* of De Blainville. It is the subgenus *Cochlohydra* of Férussac.

The shell is ovate, rather elongated, with a large, entire, longitudinal aperture, and a short spire; the outer lip is thin and continuous with the delicate sharp-edged columella; the inner lip is spread over a part of the body-whorl. The shell may be distinguished from that of *Limnæa* [LIMNEANS, vol. xiii., p. 501] by its not having a fold or plait on the columella.

Cuvier, who places the genus between *Chondrus* and *Clausilia*, remarks that the animal cannot withdraw itself into the shell entirely, and that it may be regarded almost as a TESTACELLA with a large shell. It has, he remarks, the lower tentacula very small, and lives on the herbage and plants on the brinks of streams, whence it has been considered as amphibious. [HELICIDÆ, vol. xii., p. 106.]

The most familiar species is *Succinea amphibia, Helix putris* of Linnæus, whose specific name has the priority, common in moist places, on the banks of fresh waters.

SUCCINIC ACID is obtained from amber by the application of heat, when the acid sublimes, mixed with much empyreumatic oil and some acetic acid; it is stated that a greater product is obtained when the amber is mixed before sublimation with one-twelfth of its weight of sulphuric acid diluted with an equal weight of water. The acid is purified by treating it with dilute nitric acid, by which, unlike most acids similarly constituted, it is not altered or decomposed; by evaporating the solution, crystals of the acid are procured, which possess the following properties:—they are colourless, inodorous, are acid and somewhat acrid in taste, and sublime without decomposition when heated. These crystals are hydrated, and are soluble in two parts of boiling and five parts of cold water, and they dissolve also in alcohol and æther; when heated to 356°, the crystals lose half their water. This acid consists very nearly of—

Two equivalents of carbon . .	24
Two equivalents of hydrogen .	2
Three equivalents of oxygen .	24
	—
Equivalent . .	50

The crystals contain one equivalent of water, making its equivalent number 59. Succinic acid was formerly employed in medicine under the name of salt of amber; it is now chiefly used in combination with ammonia, forming succinate of ammonia in chemical investigations, especially for precipitating iron from solution.

Succinic acid combines readily with the alkalis, earths, and metallic oxides; several of its compounds with the latter are crystallizable, but are not applied to any particular purpose.

SU'CCINUM is a bituminous substance of a peculiar kind, the natural history and chemistry of which have been already detailed. [AMBER, vol. i., 421.] It is not now used in the crude state in medicine, but is employed to yield the oleum succini, or oil of amber. This is procured by the destructive distillation of amber, which is put into a glass, copper, or iron retort, fitted with a glass alembic properly luted. A gentle heat is applied by means of a sand-bath, [illegible] which the amber is melted and a little volatile oil passes [illegible] the amber swells greatly, and the distilla[illegible]lly. By this process three very distinct [illegible]d, viz. impure succinic acid, which ad[illegible] of the retort; an acid liquid (called [illegible]cini), in which succinic and acetic acids [illegible] empyreumatic oil; and, lastly, the vola[illegible] which is to be separated from the acid [illegible] pouring off. What remains in the retort is *colophony* of amber, which is used to make varnish. The volatile oil thus obtained is impure, containing various pyrogenous ingredients, and requires repeated distillations to purify it. If in the third or fourth of these the process be interrupted when about two-thirds only of the oil has passed into the receiver, there is obtained a volatile oil of a light yellow colour, a peculiar bituminous odour, and of the specific gravity 0·880. If the distillation be continued too long, an empyreumatic oil is evolved, which gives to the other a coffee-brown hue; and this is the general appearance of rectified oil of amber. By some writers freshly prepared charcoal is directed to be put into the retort when the impure oil is to be distilled, but this is very improper, as by its means the pyrogenous principles, which it is the object of the rectification to separate, are very abundantly generated. The purest oil has a sharp burning taste, an acid re-action, and on exposure to the air becomes brown and inspissated.

Volatile oil of amber probably contains a large portion of creasote, as may be inferred from the analogous action of nitric acid on it and on creasote. One part of rectified oil of amber, and three parts of moderately strong nitric acid, form a magma, which has the odour of musk, and is called *artificial musk*. Rectified oil of amber is stimulating, antispasmodic, and rubefacient. It is now little given internally, except in combination with ammonia, in the celebrated *eau-de-luce*, for which the *tinctura ammonia composita* of the present Pharmacopœia is a substitute. This is to be applied to the nostrils in fainting, hysteria, and epilepsy, or a very few drops diluted with water may be taken internally. Oil of amber is beneficially rubbed along the spine in the later stages of hooping-cough. Dr. A. T. Thomson says that one ounce of rectified oil of amber, with half an ounce of tincture of opium, forms a good embrocation in tic-doloureux; its disagreeable odour is an obstacle to its employment when the face is the seat of the disease; but it proves a most valuable application when the limbs begin to lose their tone and swell in advanced life.

SUCCORY, commonly called Chicory, or Wild Endive, the Cichorium Intybus of botanists, which belongs to the tribe Cichoraceæ and natural family Compositæ. De Theis derives the name from *chikouryeh*, stated by Forskäl to be the Arabic name. The name Endivia seems to be derived from another Arabic name, *hindibeh*. The genus Cichorium consists of only a few species found in the temperate parts of Asia, the Mediterranean region, and in Europe. It has a double involucre, of which the exterior is 5- and the interior 8-leaved, with the leaflets united at the base; pappus crown-like, formed of many paleæ, shorter than the achenium. Receptacle naked or pitted. Flowers blue. *C. Intybus*, found in uncultivated places, dry pastures, and roadsides in Europe, has two or more heads of flowers, crowded, sessile or stalked, floral leaves lanceolate, subamplexicaul, broader at the base, pappus much shorter than the achenium. *C. Endivia*, or the common ENDIVE, cultivated throughout Europe, is supposed to have been introduced from India, where it is well known by its name of *Kasnee*. This species, like the former, has two or more heads, sessile or stalked, but with the floral leaves broad-ovate, cordate at the base and amplexicaul, pappus four times shorter than the achenium. The cultivation and uses of the ENDIVE have been treated of under that article, and of the present species under CHICORY, under which name it is more commonly known, and especially since it has been so extensively imported from the Continent as a substitute for coffee.

SUCCULA'TÆ, the name of a natural order of plants in the 'Fragments of a Natural System' of Linnæus, adopted by Bartling. It includes those families which are remarkable for the succulent character of their leaves, as Saxifragaceæ, Crassulaceæ, Ficoidaceæ, &c. All plants with thick leaves which abound with cellular tissue containing a watery secretion are called succulent. In these plants the cuticle of the leaves is remarkably destitute of stomates, and thus the transpiration of their juices is prevented. They are mostly inhabitants of arid climates, where they are supplied with only a small quantity of moisture and exposed to great heat.

SUCHONA, River. [DWINA; RUSSIA.]

SUCK, River. [SHANNON.]

SUCKERS. [STEM.]

SUCKLING, SIR JOHN, an English poet, was born at Whitton, in Middlesex, 1608-9. His father was one of

the principal secretaries of state and comptroller of the household to James I., and was by descent of a Norfolk family. The son is said to have shown in his boyhood great readiness in the acquisition of languages. We are not clearly informed as to the place and manner of his education. Aubrey thinks that he was at school at Westminster, but this fact does not seem certain. In 1623 he matriculated at Trinity College, Cambridge, and in 1628, about a year after his father's death, travelled abroad. In 1631 he joined the army of Gustavus Adolphus, king of Sweden, and probably remained on the Continent till 1632. On his return to England he led the life of a courtier, and was distinguished among his contemporaries not less by the brilliancy of his wit than by the splendid appearance which he maintained by the most lavish expenditure. Among his companions were Lord Falkland, Carew, Shirley, and Davenant; from the last of whom Aubrey derived most of his anecdotes of Suckling, whom he has thus described (*Lives of eminent Men, Bodleian Letters*, ii., part ii., 545):—'He was famous at court for his ready sparkling wit, which was envied, and Sir William (Davenant) says he was the bull that was bayted; he was incomparably ready at reparteeing, and his wit most sparkling when most set on and provoked.' While pursuing a course of fashionable pleasures, among which gambling seems to have most attracted him, he became engaged in a quarrel with a brother of Sir Kenelm Digby, and received from him a severe beating, which he does not appear in any way to have resented. After this dishonour, his associates looked coldly on him, and the consequent loss of reputation seems to have been accompanied by the decline of his fortunes. About this time we find the first notice of him as an author; in 1637 was published his 'Session of the Poets;' in 1638, his 'Aglaura;' and in 1639, his 'Brennoralt,' under the title of 'The Discontented Colonel,' a satire on the rebels. When the disturbances broke out in Scotland, Suckling equipped a troop of 100 horse in the king's service, and so magnificently, that they cost him, it is said, 12,000*l.* This extravagance was much ridiculed, and the misconduct and defeat of his men in 1639, in the battle between the Scotch and the Royal army, gave occasion for a ballad, more coarse than humorous, said to have been written by Sir John Mennis, a wit of those times, and which is printed in a poetical miscellany entitled 'Musarum Deliciæ, or the Muses' Recreation, containing several pieces of poetique wit,' 2nd edit., 1656. (Percy, *Antient Ballads*, ii., 322.) In 1640, on the meeting of the Long Parliament, Suckling was returned member for Bramber, and took an active share in the party strife that followed; a letter of his is extant, addressed to Henry Jermyn, afterwards earl of St. Albans, in which he discusses at some length the critical situation of the king. In 1641 he joined in a plot to rescue Strafford from the Tower, and was in consequence summoned before parliament, and accused of being an accomplice in a design to bring over the French; upon this he fled to France, and died soon afterwards in that country.

His death is said to have been caused by a fever, or, according to another story, inscribed on his portrait at Knowle in Kent, by a wound in the heel from a rusty nail placed purposely in his boot by his valet, who, after robbing him, wished to ensure safety in flight by disabling his master from pursuit. According to Aubrey, he poisoned himself at Paris. In a pamphlet entitled 'A Letter sent by Sir John Suckling from France, deploring his sad Estate and Flight,' London, 1641, he is said to have stayed some time at Rouen after his arrival in France, and to be then living with his wife at the Hague; but no reliance can be placed upon such a production. His death must have been before 1643, as in that year was printed, at London, 'A Copy of two Remonstrances brought over the river Stix in Caron's Ferryboate, by the Ghost of Sir John Suckling.' His works are:—1, 'Fragmenta Aurea,' London, printed by Humphrey Moseley, 1646, 8vo., with a portrait of the author, containing poems, letters, and an Account of Religion by Reason; in some of his poems he is said to have been assisted by Sir John Mennis. (Wood's *Athen. Oxon.* (Bliss), iii., 926.) 2, 'The Goblins,' London, 1646. 3, 'Fragmenta Aurea,' 1648, no portrait. 4, 'An Account of Religion by Reason,' London, 1658. 5, 'Aglaura, the Goblins, and Brennoralt,' London, 1658. 6, 'Letters to several Persons of Honour,' London, 1659. 7, 'The Sad One,' a tragedy, London, 1659. 8, 'His last Remains,' London, 1659. 9, His Works—Poems, Plays, Letters, Tonson, London, 1709, 8vo., with portrait; again, by Tonson, ibid., 1719, 8vo., with portrait; again, 12mo., 1770, no portrait; incorrectly, according to Chalmers, 'British Poets,' who has printed selections from his poems, omitting the more licentious.

A work entitled 'Selections from his Works,' with a Life prefixed by Rev. Alfred Suckling, London, 1836, has furnished nearly all the few facts contained in this scanty biography. The reader may also consult his Life, by Chalmers, the pamphlets about him already quoted; and a folio sheet printed in 1641, entitled 'The Sucklington Faction.'

In person Suckling was about the middle size, though but slightly made, with a graceful carriage. In the edition of his Works by his namesake is an engraving from a portrait by Vandyke, and two more by that master are there mentioned. His poems relate almost entirely to the passion of love; the fortunes of a lover and the feelings arising from his successes and reverses are described with the accuracy of one personally experienced in such adventures. These compositions, written in the transition period between an age of thought and learning, and an age of careless dissipation, present in singular combination the characteristics of the passing and the coming generation. In the more or less pedantic love of classical allusion, and in the strained intricacy of wit, the style of Suckling somewhat resembles that of his contemporaries; while in the licentiousness of his subjects, the gaiety and ease of expression, and the strange mixture of grossness and refinement of feeling, he still more reminds us of the court-poets of the reign of Charles II. His ballad of 'The Wedding' has been justly celebrated for the truth and naïveté of description, and the happy boldness in the use of homely imagery. The songs, 'When, dearest, I but think of thee,' and 'Tell me, ye juster Deities,' are among the best of his pieces. His letters are written in remarkably pure English, but in a style too studied and elaborate for such compositions.

SUCTORIAL CRUSTACEANS. M. Milne Edwards, in his valuable *Histoire Naturelle des Crustacés* (*Suites à Buffon*), remarks that this great division of the class *Crustacea* is connected intimately with the *Entomostraca*, and especially to the order *Copepods*, and he acknowledges that it would have been perhaps more natural not to separate it so definitely from them as he has done. For the rest, he adds, the group is distinguished from all the animals of the same class by the conformation of the buccal apparatus. In fact, he observes, the mouth, instead of being furnished with foliaceous jaws and mandibles proper for dividing solid aliments, is prolonged into the form of a beak, and cannot give passage to any but liquid substances. These crustaceans therefore are nourished by the juices which they obtain from the bodies of other animals only; and this organic disposition renders them essentially parasitic. But this peculiarity of structure, notwithstanding all its physiological importance, brings with it rather slight anatomical differences; for, in the crustaceans, as in the insects, the same parts are modified in their form, to constitute, according to the demand, an apparatus of mastication, or an organ of suction. This last is essentially composed of a conical tube resulting from the elongation of the labrum and the lower lip. There are almost always to be found two styliform pieces, which are evidently the analogues of the mandibles of the masticating crustaceans (Crustacés Broyeurs), but which here fulfil the office of small lancets, or rather, of the instrument employed in surgery in dropsical cases known as the trochar. Lastly, there exist ordinarily on each side of the base of this beak other appendages, the principal of which appear to represent the jaw-feet of the superior crustaceans, and serve the animal as the instruments to hook or attach itself to its prey. The feet are, in general, formed as in *Cyclops* [Branchiopoda, vol. v., p. 340] and the other *Copepods*, that is to say, they are short, and furnished with two natatory oars composed of many joints, and it is worthy of note, that, as in the greater part of the crustaceans, the number of these organs amounts to but four pairs; but, in the group before us, they become deformed by age, and sometimes completely disappear. Another trait of resemblance between the *Suctorial Crustaceans* and the *Copepods*, is furnished by the metamorphoses which they undergo in their youth; and it is a remarkable fact, that whilst in the adult state they offer the most variable forms, they have at their birth the ordinary conformation in all the young *Copepods*, and the greater part of the young *Branchiopods*; in the first period of their existence it is even impossible to distinguish them from the young of *Cyclops*.

M. Milne Edwards remarks that this subclass divides

itself naturally into two principal orders, and he has thought it right to add a third provisionally. This last, he observes, is ordinarily arranged by zoologists among the *Arachnids* [ARACHNIDA], but he is of opinion that their more proper place is in the class *Crustacea*. The three orders proposed by M. Milne Edwards are the *Siphonostomes*, the *Lerneans*, and the *Araneiform Crustaceans*.

1. SIPHONOSTOMES.

This order was established by Latreille, and comprehends all the *Suctorial Crustaceans* whose thorax, composed of many distinct joints, is furnished with natatory feet.

M. Milne Edwards describes these animals as having the body divided into three parts: the head, the thorax, and the abdomen. The first is large, and carries a pair of antennæ, a sucker furnished with styliform mandibles, and anchor-like or prehensile jaw-feet, generally three pairs in number. This cephalic portion of the body is, in general, more or less clypeiform, and is confounded with one or two of the first thoracic rings. The normal number of the constituent segments of the thorax is five, but in consequence of the soldering of the parts, this middle portion of the body offers mostly only two, three, or four distinct joints. The last thoracic ring is apod, and, in the female, carries two or three oviferous tubes. Finally, the abdomen is, in general, rudimentary, and is only furnished with a single pair of appendages, disposed so as to constitute ordinarily a small caudal fin. The general form of the body varies much, and sometimes departs considerably from that which may be considered as normal in this class of annulose animals.

The *Siphonostomes* undergo considerable metamorphoses in their youth, and do not become parasites till they have changed their skin once or many times: they swim at first with ease, but after having fixed themselves, they become more or less deformed, and do not quit their place except slowly and with difficulty.

M. Milne Edwards divides the *Siphonostomes* into two families—the *Peltocephala* and the *Pachycephala*.

Peltocephala.

This family has less affinity with *Cyclops* than some of the *Pachycephala*, but they offer a more complicated structure, and consequently appear to M. Milne Edwards to deserve precedence.

The *head* is very large, shield-like, and, in general, much larger than the thorax or abdomen; it resembles a disk slightly convex above, delicate on its edges, and truncated behind, where it is confounded with the first rings of the thorax. On its upper surface two small smooth eyes may be almost always distinguished; they are closely approximated to the median line. Forward it is continued with two frontal blades more or less distinct, and directed transversely. The *thorax* is composed of a variable number of joints; sometimes two only are distinguishable, sometimes three or even four may be counted, according as the three first segments are confounded with the head, or this soldering extends to but two of these rings, or even to one only. For the rest, the aspect of this portion of the body varies much, for sometimes the dorsal segment of these rings presents nothing remarkable, and sometimes it gives rise to great laminæ, which resemble the elytra of insects.

The *abdomen* is but little developed, and presents no appendage below, but terminates by two small natatory blades ciliated on the edges, or by a species of trifoliated fin.

The *appendicular system* presents, in all the animals of this division, the same essential characters, and is composed of a pair of antennæ, a buccal apparatus, and four pairs of feet.

The *antennæ*, two in number only, are inserted very far from each other, and are short, flattened, and directed outwards; they are always composed of two or three small lamellar joints, and are never setaceous nor annulated.

The *buccal apparatus* is composed of a sucker, of divers rudimentary appendages, situated on each side of its base, and of three pairs of anchor-like jaw-feet. The *sucker* is large, conical, and directed backwards; two unequal pieces are there to be distinguished, which are soldered by the edges throughout the greatest part of their length, but remain free towards the end, and leave between them, at the summit of this species of beak, a circular or triangular aperture: one of these laminæ is inserted between the mouth and the front, and represents the *labrum* or upper lip; the other, situated backwards, is analogous to the lower lip of the masticating crustaceans. Between the base of these two lips springs, on each side, an appendage, which evidently replaces the *mandibles* of these last animals; but which, instead of being short, stout, and dentiform, is slender, very much elongated, and similar to a stylet with a dentilated point; these styliform jaws penetrate into the beak by means of a slit situated near its base, and advance into its interior, so as to come out by the terminating aperture, and serve as a pair of lancets when the animal wishes to suck its prey. A little outwards is found a second pair of appendages, which is reduced to a nearly rudimentary state, and seems to be the representative of the first pair of jaws of the ordinary *crustacea*; in general there is to be distinguished near the same point a styliform or forked horny piece, which seems to be the vestige of a third pair of buccal appendages, appendages which, in the masticating crustaceans, constitute the second pair of jaws. The *jaw-feet*, three pairs in number, offer considerable dimensions, and are ranged on each side of the siphon: the first pair seem to be reflected (refoulées) forward, for they spring in front of the edge of the upper lip, between the sucker and the antennæ, and by some naturalists they are considered as antennæ; they are stout, short, more or less misshapen, and each terminated by a hooked claw, by the aid of which the animal attaches itself to its prey. The second pair of jaw-feet are slender, and always composed of two principal joints of nearly equal length, the second of which carries, near its middle, a small appendage, and terminates by one or two hooks but little bent. The third pair of jaw-feet, situated more backward, are stout, in general short, and more or less completely subcheliform; the crooked claw which terminates them can be bent back on the penultimate joint, in manner of a claw.

The *feet* are four pairs in number, and are always more or less completely natatory; two pairs, and sometimes all, terminate by two oars, each composed of three joints, offering, generally, a very remarkable disposition of a nature to favour their action as natatory instruments, and which consist in a very considerable development of their basilary joint, and the soldering of that joint with an unequal sternal piece, so as to form, with the whole, a single transversal blade, as for the two feet; it is even to be remarked, that in general this basilary piece, which occupies the whole width of the corresponding ring, is much more developed than the terminal oars of those limbs, and constitutes, by itself, nearly the whole of the fin formed by the pair of feet thus modified. These four pairs of limbs belong to the four first thoracic rings, and spring, some from the cephalic buckler, others from the postcephalic portion of the thorax, varying in number according to that of the thoracic rings, which are confounded with the head. The last ring of the thorax carries none; but, in general, a pair of tubercles or lobules may be distinguished there, which appear to be the vestiges of a fifth pair of limbs reduced to a rudimentary state.

These crustaceans live as parasites upon fishes, but they are not permanently fixed to them, and when they let go their hold, they can change their place either by crawling slowly or swimming. The male is, in general, distinguished from the female by some peculiarities of structure, and by a very inferior size. The female nearly always carries her eggs in cylindrical tubes, which spring near the posterior border of the last thoracic segment on each side of the abdomen, and which often attain a very considerable length. The young, at their birth, resemble the young of *Cyclops*, and must undergo many moults before they finish their metamorphosis; little however is known at present of these changes. It is also to be noted that one often finds in the neighbourhood of the vulvæ small ampullæ, which are fixed there by a very narrow neck, and which may be spermatic reservoirs, analogous to those which M. Siebold made known in *Cyclops*.

M. Milne Edwards divides this natural family into three divisions or tribes—the *Argulians*, the *Caligians*, and the *Pandarians*.

Argulians.

This tribe consists of a single genus, *Argulus*, which infests fresh-water fish and the tadpoles of Batrachians, to which they adhere, but they are also found free, swimming about with vivacity.

Argulus foliaceus is known to most anglers: it is figured in Desmarest (*Crust.*, pl. 50, fig. 1), and there is a pretty wood-cut of it in Yarrell's *British Fishes*, vol. ii., p. 399.

Caligians.

There is nothing abnormal in the conformation of the thorax of this tribe, the thoracic rings being simple, and without dorsal appendages. The cephalic buckler is large, more or less oval, delicate on its edges, and furnished anteriorly with very well developed frontal laminæ, the lateral extremity of which covers the base of the antennæ: the posterior angles of this carapace are prolonged more or less far on each side of the thorax, and the portion of its posterior border, comprised between these two prolongations, is confounded with the first, or even the second or third first thoracic segments. The result is, that the thorax is only composed of two, three, or four distinct joints. The feet are furnished with long plumose bristles; and the abdomen is terminated by two small plates directed backwards, and carrying no lateral appendages.

Genera.

Caligus (see the article and the arrangement of M. Milne Edwards, who divides the genus into several sections, and records no less than fifteen species), *Chalimus*, *Trebius*, and *Nogagus*.

Pandarians.

The small crustaceans collected by M. Milne Edwards under this name, are remarkable for the lamellar prolongations with which the upper part of their thorax is furnished. These appendages, he observes, often resemble the elytra of insects, and their number is sometimes considerable; there may be as many as three pairs counted. In general the head is less enlarged and less clypeiform than in the *Caligians*, and the feet are only rarely furnished with plumose setæ; their terminal oars are often only represented by foliaceous submembranous lobes; and the abdomen frequently presents on each side of its terminal piece a more or less projecting lamellar appendage.

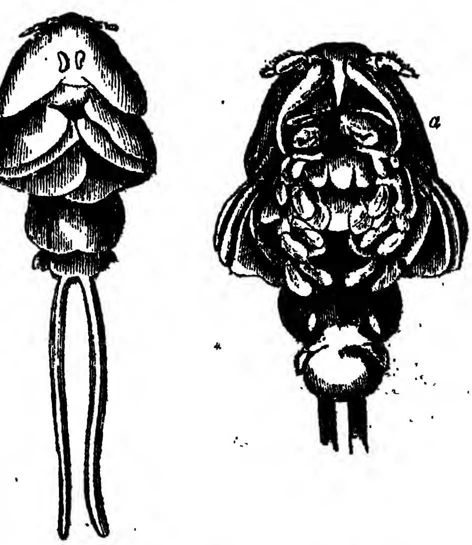
M. Milne Edwards subdivides this tribe into two small groups, principally characterised by the general form of the body, and by the disposition of the oviferous tubes, which in the one are exposed and extended in a straight line behind the body, whilst in the other these tubes are coiled upon themselves and hidden between the superior surface of the abdomen and a clypeiform lamina which springs from the last thoracic ring.

The genera *Euryphorus*, *Dinemoura*, *Pandarus*, and *Phyllophora*, form the first of these groups. *Cecrops* and *Læmargus* belong to the second.

Our limits will only permit us to illustrate this tribe by the genus *Phyllophora*.

The type of this last-named genus is, according to M. Milne Edwards, who established it, very remarkable from the lamellar appendages with which its back is covered. In its aspect it approaches the *Anthosomes*, but in the structure of its feet and in its general organization it is not separable from the *Pandarians*. The only species known is *Phyllophora cornuta*. Length about ten lines.

Locality.—Near Tongataboo.



Phyllophora Cornuta. (M. E.) *a*, seen from below

Pachycephala.

In this division of the order *Siphonostomes*, M. Milne Edwards describes the head as not enlarged, but lamellar and clypeiform as in the preceding family, and the antennæ, instead of being short, flattened, and biarticulate, as slender, cylindrical, elongated, and composed of five or six joints, the size of which diminishes gradually from the base towards the point of the organ. It is also to be noted that the apparatus of suction is, in general, less developed in these crustaceans, than in the *Peltocephala*, and the mode of conformation of these appendages which would appear to represent the jaw-feet is less constant: the feet are not soldered on the median line, and consequently do not constitute unequal fins, as is often the case in the preceding family.

M. Milne Edwards divides the *Pachycephala* into two natural groups. The *Ergasilians* and the *Dichelestians*: the first, he observes, establishes the passage between *Cyclops* and the *Lernæidæ*; the second, between these last and the *Pandarians*.

Ergasilians.

This small group closely approximates to *Cyclops*, and is remarkable for the pyriform conformation of the body, the size of the head, and the development of the abdomen.

Genera.

Ergasilius, *Bomolocus*, and *Nicothoa*. Species of *Ergasilius* are found attached to the gills of the pike and carp (*Erg. Sieboldii*); to those of the eel (*Erg. gibbus*); and to those of a *Silurus* (*Erg. trisetaceus*). The only species of *Bomolocus* known (*Bom. Belones*) is found attached to the branchiæ of the gar-fish (*Esox Belone*). *Nicothoa* includes but one species (*Nic. Astaci*) which is of a rosy colour, about a line in length, and is found upon the branchiæ of the lobster. The young *Nicothoæ*, on leaving the egg, resemble the young of *Cyclops*, and want the thoracic lobes which, when they are adult, give so strange an aspect to these animals.

Dichelestians.

This tribe is easily distinguished from the *Ergasilians* by the elongated form of the body, the smallness of the head, and the frequently rudimentary state of the abdomen. It is also worthy of note that their feet are much less developed than in the *Ergasilians*, and that the organs by the aid of which they fix themselves on their prey, are, on the contrary, more developed, announcing a more essentially parasitic life.

Genera.

Anthosoma, *Dichelestium*, *Nemesis*, *Lamproglena*.

But one species of *Anthosoma* is known (*Anth. Smithii*), about ten lines long, and found upon a *Squalus*. M. Milne Edwards remarks that the *Caligus crassus* of Abildgaard much resembles this species, but seems to be more stout about the head, and to have the cephalic buckler wider forwards.

Dichelestium, too, comprises but one species (*Dich. Sturionis*). It is about one inch in length, and fixes itself on the branchial apparatus of the Sturgeons. The thorax is divided into four portions in the male, and into five in the female, by interannular divisions. The abdomen is very small in the female, about half as large as the last thoracic ring in the male. Neither does *Lamproglena* include more than one species (*Lamp. pulchella*), which is found on the gills of the chub.

Lerneans. (Lernæidæ, M. E.)

This order is principally distinguished from the *Siphonostomes* by the rudimentary state of the whole appendicular system, which is only represented by vestiges of limbs or simple tegumentary lobes without articulations, and proper only to serve for anchoring the animal on the prey at whose expense it lives. The *Lerneans* are remarkable for the oddity of their shape, which, in general, departs greatly from all the ordinary forms in this class, and seems to be the result of a monstrous development. In youth their conformation is normal and much resembles the young of *Cyclops*; they are then provided with a frontal eye, and natatory oars which permit them to move with agility; but, after having undergone a certain number of moults, they cease to lead an erratic life. The females fix themselves on some other animal, and the males, which are much smaller, hook themselves, in general, under the abdomen of their female and near the vulvar aperture. The organs of locomotion, then rendered useless, waste away or become deformed, so as to be unfit for the office which they were originally intended to execute. The eye nearly always dis-

appears, and the general configuration of the animal changes, so as to make it not recognisable. The females especially acquire the most singular forms. They become very large, and solder themselves, so to speak, on their prey by the aid of simple cutaneous appendages or certain members transformed into immovable arms. The males remain extremely small, and depart less from their primitive conformation, but the head becomes larger, and the jaw-feet, transformed into instruments of prehension, and destined to fix the animal on the part which is to be its habitat, acquire a great relative development.

We must here pause for a moment, to mark this provision for the welfare of the animal. If all the young went to one fish, that of the parent for example, as would probably be the case if they were born blind and with organs only fit for attachment, the fish would die, and the whole generation of parasites would be defunct with it. But the young *Lernæa* is hatched in a form that enables it to swim about and feed on minute animals; and, being furnished in this state with eyes, it has not only the means of temporary subsistence whilst leading a wandering life, but also of selecting its proper species on which it is destined to feed. Then the locomotive limbs are gradually changed to organs of attachment, the eyes disappear, nutrition is the object till the organs of generation are fully developed, and, in this, as in some other cases, the perfection of the animal consists not in the enjoyment of locomotion and vision, but in that state which renders it fit for the continuation of the species.

M. Milne Edwards remarks, that zoologists have mistaken the true nature of the Lerneans, and have separated them from the *Crustaceans*, to place them among the worms. Desmarest, he observes, is one of the first authors who have clearly indicated their natural relationship with the ordinary crustaceans; but, he adds, it is only since the knowledge of the transitory forms put on by these parasites in the commencement of their life, that one has been able definitively to assign to them a place in the natural series of the crustaceans, and the acquaintance with these changes is principally due to that skilful observer, M. Nordmann. M. Milne Edwards observes, that there is no branch of the natural history of the crustaceans so little advanced as that relative to the *Lerneans;* nearly all remains to be done, and he expresses a hope that M. Nordmann will not abandon a pursuit which has already conducted him to results so important to science.

M. Milne Edwards divides the *Lerneans* into three families, characterised by the manner in which these parasites attach themselves to their prey. Some fix themselves by means of great brachiform appendages, united together towards the end, and terminated by a horny median *bouton.* Others adhere by their jaw-feet, which are armed with very strong hooks. Others again attach themselves by the whole head, which is furnished for this purpose with horny prolongations of various forms. The first correspond to the *Lerneopods* of M. de Blainville, and may be designated as *Lerneopodians;* the second have the genus *Chondracanthus* for their type, and form M. Milne Edwards's family *Chondracanthians;* and the third he denomintes *Lerneocerians,* because the genus *Lerneocera* belongs to that family, and the name recalls one of their principal characters. With regard to the establishment of generic divisions, and the characters of species, he can only, he observes, refer, in the greater number of instances, to the mode of organization in the females; for the males are nearly entirely unknown to him, and, in his descriptions, the females are designated, unless the contrary is specified.

Cnondracanthians.

The female *Chondracanthians* fix themselves upon their prey by the aid of small anchor-like jaw-feet, inserted at the anterior extremity of the head, and under the front. The thoracic appendages do not serve for the same use, and have the form of ordinarily two-oared feet of extreme smallness, or fleshy lobes, free at their extremity, and not prehensile. The head is, in general, tolerably distinct from the thorax, and nearly always carries a pair of antennæ, and two pairs of unciform and anchor-like jaw-feet. On the sides of the mouth may be ordinarily perceived a pair of appendages, which represent the second pair of jaw-feet, and which are sometimes anchor-like, similar to the others, but are often rudimentary. The mouth is sometimes situated very far behind the anterior jaw-feet, and is armed with small appendages representing the mandibles. The number and disposition of the appendages corresponding to the thoracic feet vary; sometimes two pairs only are to be counted, sometimes three, and even four. The oviferous tubes spring from the posterior edge of the body, so that the abdomen is rudimentary, and is only represented by one or two small median tubercles. The male is often found attached under the anus of the female: he is extremely small, and does not resemble her in the least, but differs little from the males of the succeeding family. (M. E.)

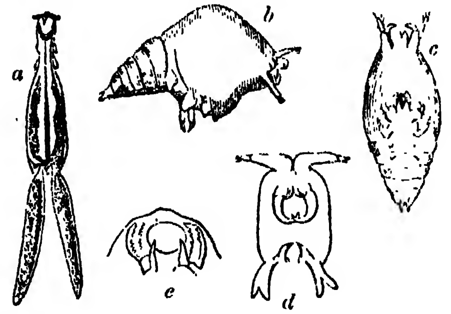
Genera.

Selius, Æthon, Clavella, Cycnus, Tucca, Peniculus. Lernanthropus, Chondracanthus.

Selius consists but of one species (*Sel. bilobus*), found on the branchiæ of the Dotted Polynöe; nor does *Æthon* comprise more, consisting only of *Æthon quadratus*, found on a *Serranus*, and about a line in length. *Clavella* has two species; *Cl. Hippoglossi*, found on the Holibut, and *Cl. Scari*. *Cycnus* has only one species (*Cyc. gracilis*), found on the branchiæ of a cod-fish; and this is the case with *Tucca*, which has only one (*Tuc. impressus*), found on *Diodon Hystrix*. *Peniculus* has but one (*Pen. Fistula*), found on *Zeus Aper*. *Lernanthropus* consists of two species, separated by M. Milne Edwards into two sections; *Lernanthropus Pupa*, found on a Brazilian *Platax*, and *Lern. paradoxus*, found on the mullets. M. Milne Edwards remarks that *Lernanthropus Musca* (De Bl.), found on a *Diodon* from Manilla, belongs to his first section.

Chondracanthus is separated by M. Milne Edwards into two sections, with subdivisions, and contains seven species:

Ch. cornutus, found on several flat-fish (*Pleuronectes*); *Ch. crassicornis*, found on a wrasse; *Ch. Soleæ*, found on soles; *Ch. Triglæ*, found on gurnards; *Ch. Merlucci* (from which the *Ch. Xiphiæ* of Cuvier does not appear to M. Milne Edwards to differ, and to which he thinks *Lernæa radiata* of Müller, found in the buccal cavity of *Coryphæna rupestris*, appears to be very close); *Ch. Zei;* and *Ch. Delarochiana*, the last found upon the thunny.



Chondracanthus cornutus.

a, female magnified after Nordmann; *b*, male seen in profile and more highly magnified; *c*, the same seen from below; *d*, head of the female seen from below; *e*, mouth still more highly magnified.

Lerneopodians.

In the females of this group the head is formed nearly as in the *Chondracanthians*, that is to say, distinct from the thorax, furnished with a pair of antennæ, and armed with two pairs of anchor-like jaw-feet. But the anterior jaw-feet are less proper for serving these small crustaceans for attaching themselves to their prey, and the thorax, which carries neither feet nor fleshy appendages, similar to those which represent the two first pairs of thoracic members in the preceding division, give origin to a pair of very large brachiform prolongations, which unite together sometimes at their base, sometimes towards their extremity only, and terminate by a horny *bouton*, by the aid of which the parasite strongly adheres to the animal on which it has established its dwelling. These organs of adhesion appear to replace the first pair of thoracic limbs.

The male of only a small number of *Lerneopodians* is known, and where known differs extremely from the female. He has the body divided into two very distinct parts; one anterior, the cephalic, which carries the antennæ, a pair of anterior unciform jaw-feet, the sucker, and, farther back, two pairs of well-developed appendages, which represent the posterior jaw-feet and the arms of the female, but which have the form of stout hands carried on a cylindrical peduncle, and terminated by a small ill-formed pincer. The young undergo the ordinary metamorphoses. (M. E.)

There are six genera:—*Tracheliastes*, *Basanistes*, *Achtheres*, *Brachiella*, *Lerneopoda*, and *Anchorella*.

Thacheliastes has three species, divided into two sections: *Tr. polycolpus*, found on the fins of the chub; *Tr. maculatus*, found on the scales of the bream; and *Tr. Stellifer*, found on the branchial arches or within the mouth of *Silurus Glanis*.

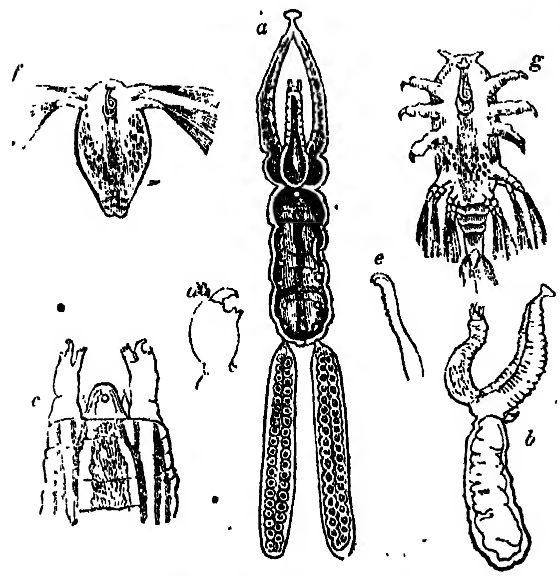
Basanistes comprises two species:—*Bas. Huchonis*, found on the gill-cover of the huchen (*Salmo Hucho*), and *Bas. salmonea*, found on the grayling. M. Milne Edwards states that *Lerneopoda Brongniartii* (De Bl.) belongs to this genus.

Achtheres consists of but one species (*Ach. Percarum*), found on the fins of the river Perch and of the Sandra. Length about two lines.

Brachiella comprises five species, distributed into two sections, with subdivisions:—*Brachiella Thynni* (length about ten lines, of male about half a line), found on the gills of the Thunny; *Br. impudica* (length about four lines, of male about a third of a line), found on the gills of the Haddock (*Gadus Æglefinus*); *Br. bispinosa* (about three lines in length, male unknown), found on the gills of the Sapphirine Gurnard (*Trigla Hirundo*); *Br. rostrata*, closely approaching the preceding, found in the Greenland Seas upon *Pleuronectes pinguis*; and *Br. Lophii*, found on the gills of the Sea-Devil, Toad-fish, or Frog-fish, at Naples.

Lerneopoda consists also of five species, divided into two sections:—*Lerneopoda stellata*, found on the fins of a Sterlet in Norway; *Lern. elongata* (about two inches in length), found fixed to the eye of a Shark in the Polar Seas; *Lern. Carpionis*, nearly approaching the preceding, found on the Salmon in the north of Europe; *Lern. Galei* (length about three lines, male about the same size), found on the fins of a Tope Shark (*Milandre*); and *Lern. obesa* (about two lines in length), found upon *Squalus Acanthias*, the Picked-dog, or Hound-fish.

M. Milne Edwards thinks that *Lern. Dalmanni*, found on *Raia Batis*, the Skate; *Lern. bicaudata* (about two lines long), found on the Red Gurnard; and *Lern. salmonea*, belong to this genus. The last species does not seem to M. Milne Edwards to be determinable specifically, and he makes the same remark on the *Lernæa* found by Hermann on the Dace.



Tracheliastes polycolpus. (M. E.)

a, female magnified and seen from above; *b*, the same seen on the side and deprived of the oviferous bags; *c*, anterior extremity of the body more highly magnified; *d*, appendage representing the second pair of jaw-feet; *e*, mandible; *f*, larva of the same; *g*, second age of the larva.

Of *Anchorella* five species are recorded, distributed into two sections:—*Anch. emarginata* (about six lines long), found upon the gills of the Wolf-fish (*Anarrhicas Lupus*); *Anch. brevicollis* (about four lines long), found fixed on the anal fin of the Variable Cod-fish (*Gadus callarias*); *Anch. ovalis* (about two lines long), found upon the Red Gurnard; *Anch. rugosa* (about three lines long), found on the Wolf-fish; and *Anch. uncinata*, found on the gills of divers *Gadi*.

M. Milne Edwards is of opinion that *Lerneomyzon pyriformis* and *Lerneomyzon pinnarum* (De Bl.) belong to this genus, as well as *Lernæa adunca* of Strom and *Lernæa anomala* of Abdilgaard.

Lerneocerians.

The female *Lerneocerians*, like the *Chondracanthians*, fix themselves to their prey by the anterior extremity of their body only, and have no brachiform thoracic appendages serving for this purpose, as may be seen in the *Lerneopodians*; but the arming of their mouth is far from having the form which this apparatus offers among the *Chondracanthians*, and the whole head of the parasite is plunged in the tissue of the animal on which it establishes its dwelling, and is there retained by horny prolongations, of varied form, which spring from its posterior or occipital part. In general the head is not very distinct from the thorax, and seems to be completely deprived of antennæ; the mouth is armed with but one pair of jaw-feet, which are simple and unciform. The feet, when they exist, are of extreme smallness, and sometimes no trace of them is to be perceived. The portion of the trunk which is situated behind the point where the oviferous tubes take their origin, and which represents the abdomen, is, in general, much more developed than in the other females of the same order.

The *male* of the *Lerneocerians* is unknown, except in very few species; and, where known, seems as imperfect as that of the *Chondracanthians*; his body is globular, offers no distinct thorax, and does not carry rudiments of feet behind the appendages which represent the jaw-feet. The metamorphoses which the young undergo are analogous to those of the other *Lerneocerians*. (M. E.)

Genera.

Penella, *Lerneonema*, *Lerneocera*, *Lernæa*.

Penella consists of four species, divided into two sections:—*Pen. Sagitta* (about four inches long), found on *Lophius marmoratus*; *Pen filosa*, and *Pen. Blainvillii*, the last found on the Flying-fish, *Exocætus volitans*; and *Penella Sultana* (about an inch long), found in the mouth of *Carenx Ascensionis*.

Lerneonema, also divided into two sections, comprises three species:—*Lern. Lesuerii* (about two inches long), found in the American Seas upon the Flying-fish; *Lern. monilaris* (about an inch long), found fixed to the sclerotic coats of the eye of the Sprat (*Clupea Sprattus*); and *Lern. abdominalis* (about twenty lines long).

M. Milne Edwards states that *Lerneocera surriraiis* (De Bl.) belongs to this group, and that it much resembles the preceding species, but is distinguished by the brevity of the abdominal portion of the body; and he is of opinion that the genus *Sphyrion* of Cuvier is too imperfectly known to enable him to determine its natural affinities, though it appears probable to M. Milne Edwards that its place is between *Penella* and *Lernæa*.

Lerneocera comprises four species, divided into two sections and subdivisions:—*Lern. cyprinacea* (about eight lines long), found in Sweden on *Cyprinus Carassus*; *Lern. esocina*, *Lern. cruciata*, found in Lake Erie, on *Cichla ænea* (Lesueur); and *Lern. radiata*, found on *Clupea Tyrannus*, United States of America.

M. Milne Edwards thinks that *Lernæa ocularis* of Cuvier belongs to the second section of the genus *Lerneocera*. It is found fixed to the eye of Herrings.

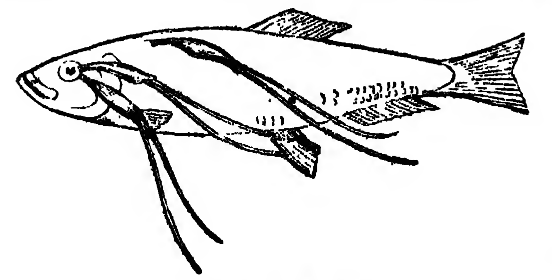
Lernæa consists of two species, each placed in a separate section:—*Lernæa branchialis*, found on the gills of several species of *Gadi*, in the North Sea; and *Lernæa multicornis*.

M. Milne Edwards states that *Lernæa cyclopterina* is distinguished from *Lernæa branchialis* by certain tubercles about the head and neck. He remarks that M. Kroyer has represented it without horns, but he thinks that arose from the mutilation of the animal observed by M. Kroyer. This parasite is found in the Greenland Seas on *Cyclopterus spinosus*.

Lerneonema monilaris, magnified. (M. E.)

The subjoined cut, from Sowerby's 'Miscellany,' shows the external appearance of a sprat infested by these Lerneans. Mr. Sowerby names the parasite *Lernea Sprattæ* (*Lernæa Spratti*). These crustaceans are stated to be lumi-

nous at night; and the fishermen say that the shoal is often headed by fish so infested, which they call Lanthorn Sprats.



Lerneans in situ on a Sprat.

ARANEIFORM CRUSTACEANS, OR PYCHNOGONIDS.

M. Milne Edwards states that it is not without doubt that he has arranged in this place a small group of articulated animals which have been considered by the greater part of zoologists as belonging to the class of *Arachnids*, but which seem to him to have more analogy with the *Crustaceans*, for they have no tracheæ nor pulmonary sacs for aerial respiration, and appear to respire oxygen beneath the water only by means of the general surface of the common teguments, as he had already pointed out in many inferior crustaceans.

In the general form of the body these animals approach the LÆMODIPODA, and especially *Cyamus*. Their *head* is elongated, sometimes cylindrical, sometimes conical, and presents at its extremity a trilobated buccal orifice. The *thorax* is constantly divided into four segments, and the *abdomen* is only represented by a small tubular joint fixed to the posterior edge of the last thoracic ring. The head carries no appendages, and the eyes, four in number, are grouped on a small median tubercle, situated on the dorsal surface of the first joint of the thorax. This segment often carries at its extremity a pair of jaw-feet terminated by a well-formed pincer, and sometimes furnished with a palp, which is elongated and composed of many joints. In the male, the number of pairs of feet is equal to that of the joints of the thorax; but in the female there is a pair of pediform supplementary appendages fixed to the first joint of the thorax, bent back under the feet properly so called, much smaller than them, and serving to carry the eggs. The feet are very long, directed outwards, and composed of nine joints, the last of which constitutes a more or less sharp claw.

The digestive tube traverses the body in a straight line, and presents in one of the genera of this family (*Nymphum*) a very remarkable disposition; it gives origin, to the right and left, to a series of prolongations, which are tubular and closed above, which advance very far in the interior of the corresponding feet, and which are the seat of a peristaltic motion. There exists besides a vague circulation. No trace of respiratory organs is perceptible, and the disposition of the organs of generation is not known; it is only to be remarked that in the *Pychnogonons* may be perceived on the second joint of the posterior feet a pore which seems to be the orifice of this last apparatus.

The *Pychnogonids* are all of small proportions, and live in the sea; some are found under stones, others live, it is said, hooked on to fish or other marine animals; but, otherwise, nothing is known relative to their habits.

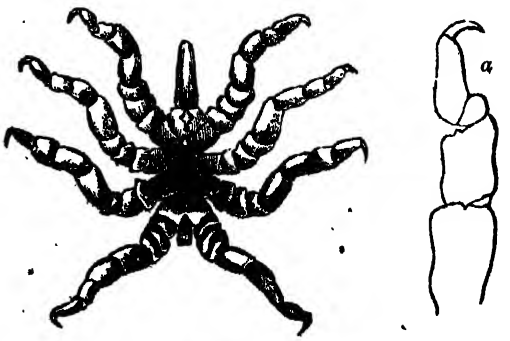
These animals form a small family, which Dr. Johnston, to whom zoologists are indebted for a good work on this subject, divides into five well-characterised genera. (M.E.)

Genera.

Nymphum, *Pallene*, *Phoxichilidium* (*Orythia*,* Johnston), and *Pychnogonum*.

Our limits will only allow us to illustrate this group, which still requires the close attention of the physiologist and comparative anatomist, by one genus. *Pychnogonum* is distinguished from its congeners by the stoutness of its form, and the size and shortness of its feet, which are strongly contrasted with those of *Nymphum gracile*. Only one species appears to be known, *Pychnogonum littorale*; the accessory feet of the female are very short. Length about four lines. This Araneiform crustacean inhabits our seas and those of France, and is found on Ascidians and various fishes.

* Previously used for another crustacean. [OXYSTOMES.]



Pychnogonum littorale, magnified.
a, foot of the same, more highly magnified.

The reader should refer to the writings of Fabricius, Latreille, Brunnich, Montagu, Lamarck, Leach; and especially of Dr. Johnston, in *Zool. Journ.*, *Miscell. Zool.*, and *Mag of Zool. and Botany*, relative to this highly interesting order of animals.

SUDBURY. [SUFFOLK.]

SUDERMANIA. [SWEDEN.]

SUDETES, or SUDETCH MOUNTAINS. [GERMANY.]

SUDRAS. [HINDUSTAN, p. 231.]

SUET is a variety of the fatty or adipose tissue of animals, accumulated in considerable quantity about the kidneys and the omentum, or caul, of several of the domestic quadrupeds. There are several kinds of it, according to the species of animal from which it is procured, such as that of the hart, the goat, the ox, and the sheep (ovis aries). This last, which is whiter than beef-suet, is officinal. It belongs to the class of saponifiable fats. In the recent state it is white, easily broken, being solid at the ordinary temperature of the air, subdiaphanous, scarcely possessed of odour, or only of a slight peculiar one, due to the hircine, which in the process of saponification evolves a volatile strong-smelling acid (hircinic acid of Chevreul), but possessing a very disagreeable one when putrifying. It readily spoils on exposure to the air, becoming rancid and yellow, but may be restored again to whiteness by chloride of lime or chloride of magnesia. For this purpose, for each hundred parts of suet from two to four parts of chloride of lime are to be dissolved in from four to eight times its weight of water, and to be mixed warm, and as much dilute sulphuric acid is to be added as is necessary to decompose the chloride.

Suet consists of about three-fourths of stearine, with some elaine, and a little hircine, and margarin; the preponderance of stearine renders it the most solid of animal fats. It liquefies with a gentle heat, and the prepared suet of the Pharmacopœia is obtained by melting it over a slow fire, and straining it, to separate the membranous portion. It is used as an ingredient in cerates, plasters, and ointments.

After being melted, it is little prone to spoiling, and by pouring it over various articles, such as potted char, from which it thoroughly excludes the air, it assists greatly in preserving them.

It has been employed also by M. Ludensdorff for preserving the *fleshy fungi*, or mushrooms, by boiling them in it (which thus filled their pores and cells, and penetrated the very substance), and then covering them with a coat of varnish. It does not however always succeed in preserving the colour and form. (See Klotsch, in Hooker's *Botanical Miscellany*, ii., p. 159.)

SUETO'NIUS (CAIUS SUETONIUS TRANQUILLUS). The few particulars which are known of the life of Suetonius are derived chiefly from his own writings and from the epistles of his friend the younger Pliny.

The time of his birth is not known, but as he states that he was a young man (adolescens) twenty years after the death of Nero, the time may be fixed approximately. He also says that his father was Suetonius Lenis, a tribune of the thirteenth legion, and of equestrian family (*Oth.*, 10); and that he was in the battle of Bebriacum, in which Otho was defeated by Vitellius. It has been remarked that the name Lenis signifies the same as Tranquillus; but it is said, that instead of 'Lenis,' some manuscripts have 'Lætus.' There are extant several letters from Pliny the

Younger to Suetonius, the son, from one of which (i. 18) it appears that Suetonius was then practising at the bar. In another letter (v. 11) Pliny urges him to publish some works which he had written. At the request of Pliny, Trajan granted Suetonius the Jus trium liberorum, by which he obtained all the privileges of those who actually had children, and was freed from the disabilities imposed by the Lex Julia et Papia Poppaea on those who were married and had no children. He was Magister Epistolarum to Hadrian, but lost his office at the same time that Septitius Clarus, who was Praefectus Praetorii, and many others were dismissed by Hadrian on the ground, which is very obscurely stated, that they had, without the emperor's permission, conducted themselves towards his wife Sabina with more familiarity than was consistent with the respect due to the Imperial family. (Ael. Spart., *Hadrian*, ii.)

Nothing more is known of Suetonius. His friend Pliny calls him a most upright and learned man, whose character rose in his estimation the better he became acquainted with him. Suetonius was a voluminous writer; a list of his works is given by Suidas (v. Τράγκυλλος) as follows: one book on sports or pastimes among the Greeks; two books on Roman games and shows; one book on the Roman year; one book on the notes or marks used in writing; one book on the 'Respublica' of Cicero; a treatise on proper names, and the forms of garments, shoes, and other articles of dress; a treatise on words of bad omen; two books on Rome and its institutions and manners; a work in eight books on the Cæsars from Julius Cæsar to Domitian, which is still extant; and a Stemma or Genealogy of illustrious Romans. He also wrote a work on kings, in three books; a work entitled 'De Institutione Officiorum;' a work on the Praetors, the eighth book of which is quoted by Priscian; and a work 'De Variis Rebus.'

The only complete work of Suetonius, which is extant, is the 'Lives of the Twelve Cæsars,' now printed in twelve books or parts, but sometimes distributed into eight books, as appears from Suidas and from several manuscripts. This work comprehends, as already observed, the Cæsars from C. Julius Cæsar, the Dictator, to Domitian, both included. It has been conjectured that the first part of the Life of C. J. Cæsar is wanting, because it begins rather abruptly with the events of his sixteenth year: but the conjecture has nothing else to support it. The biographies of Suetonius are peculiar in their construction. He does not strictly follow the chronological order of events. There is no attempt at rhetorical ornament or effect: the style is characterised by correctness, brevity, precision, perspicuity, and simplicity; there are no idle words. There is an air of impartiality about the whole work, from which a reader derives greater confidence in the truth of the narrative, than from the laboured pictures of Tacitus. Vopiscus calls him a faultless and most impartial writer, and a lover of brevity. The vices of the Cæsars are stated circumstantially and drily, as facts well ascertained. These biographies abound in facts. Indeed their chief merit consists in being a most copious source of materials. Accordingly the style has been appropriately called by La Harpe anecdotical. That Suetonius was a learned Roman, as his friend Pliny states, is apparent from his work. He seems to have had a competent knowledge of the antiquities and the institutions of his country. Like Tacitus, he frequently mentions the legislative enactments (*Senatus Consulta*) which were passed under the Cæsars, but neither is he nor any other Roman historian always a safe guide in such matters. The work of Suetonius does not affect to be historical, yet it comprehends a brief notice of all the public events which happened in the life of each Cæsar. It is a valuable work for the early Imperial times, and if used judiciously with the other authorities, it might form the basis of something like a satisfactory history of this period. He consulted official documents, and availed himself of sources of information which are now entirely lost.

The editions of the 'Lives of the Cæsars' are very numerous. About fifteen editions were printed before 1500. The oldest edition that bears a date is that of Rome, 1470, fol., by G. A. Campani. One of the best editions is that of Isaac Casaubon, fol., Paris, 1610. There is a small useful edition, with a selection of notes, by J. Schild, 8vo., Lugd. Bat., 1647, &c. Among the other editions of Suetonius are those of J. G. Graevius, Oudendorp, and Ernesti. A list of the editions is given in Schweigger's 'Handbuch der Classischen Bibliographie,' Leipzig, 1834. The 'History of the Twelve Cæsars' was translated into English by Philemon Holland, fol., London, 1606. There are four other English translations, the last of which is by A. Thomson, 8vo., London, 1796, 'with annotations and a review of the government and literature of the different periods.' There are French, Dutch, German, Danish, Italian, and Spanish translations. There is also extant a small treatise 'On Distinguished Grammarians' by Suetonius; and another 'On Distinguished Rhetoricians,' consisting at present of only six chapters. Neither of these works is included in the catalogue of Suidas, unless they belonged to the work 'On the Stemma of Illustrious Romans,' which however, if we may judge from its title, would be a different kind of work. It has been conjectured that they formed part of a work 'De Viris Illustribus' (not the work extant under that title, which belongs to Aurelius Victor), on the model of which, Jerome says, in an epistle to Desiderius, that he himself wrote a treatise. There are also extant the following Lives by Suetonius: the Lives of Terence, Juvenal, Persius, Horace, Lucan, and the elder Pliny; the last is only a few lines. These Lives are conjectured to have been part of a larger work 'On Poets.' But the Life of the elder Pliny would not properly belong to such a treatise.

SUETONIUS, PAULLI'NUS. [ATLAS; BOADICEA; BRITANNIA.]

SUEUR, EUSTACHE LE, one of the most celebrated of the French painters, was born in 1617. His father was an obscure sculptor of Mont Didier. After he had learnt from his father the first rudiments of design, he was placed in the school of Simon Vouet at Paris, then very famous, where he was the fellow-scholar of Le Brun and Mignard. Le Sueur soon surpassed his master, and forsook his manner, and by assiduously studying the antique, and some of Raphael's pictures and the prints after him by Marcantonio, he adopted a style, which for its simplicity and severity contrasted greatly with that of Vouet and the French school of the time, and has at length placed the name of Le Sueur deservedly above that of any of his rivals. He has been termed by his admirers the French Raphael; and although he was far behind that great master in every respect, even in colouring, yet he perhaps approached him more nearly in the style of his heads and draperies, and in the general character of his compositions, than any of his Italian imitators.

The celebrated series of St. Bruno, of twenty-two large pictures, painted on wood, in the cloister of the Carthusians at Paris, was executed by Le Sueur before his thirtieth year; he completed it in three years, and was assisted only by his brother-in-law and scholar Goussé, or Goulai, in the figures, and by Patel in the landscapes. In 1766 these pictures were transferred to canvas, and are now in the Louvre. The character and the composition of several of them are admirable, but in chiaroscuro they are very indifferent, and the colouring is monotonous: they have been engraved by Chauveau and Le Clerc. In his thirty-second year, in 1649, he painted his celebrated picture of St. Paul preaching at Ephesus, and the Gentiles burning their proscribed Books, for the guild of the goldsmiths, to be presented to the cathedral of Notre Dame; it is a grand composition of many figures, the heads and the draperies are much in the style of Raphael: it has been engraved by Stephen Picart and R. U. Massard. Paul Healing the Sick, engraved by Bauzo and the elder Massard, and the Martyrdoms of St. Laurence and of St. Protais, both engraved by Gerard Audran, are also admirable compositions, conspicuous for their simplicity and severity. Le Sueur painted many other celebrated pictures, as, Christ scourged; Christ with Martha and Mary; and the Presentation in the Temple; the histories of St. Martin and St. Benedict; and others—all of which have been engraved by the best French artists. His most extensive works however, by some considered his best, and which occupied him the last nine years of his life, were the mythological paintings of the Hôtel du Châtelet, executed for the President Lambert de Thorigny: they were removed to the Louvre in 1795. The palace was decorated by Le Sueur and Le Brun conjointly; three apartments were painted by Le Sueur, the 'Salon de l'Amour,' the 'Cabinet des Muses,' and 'l'Appartement des Bains.' In these paintings Le Sueur has still adhered to his great model, and has imitated the style of the celebrated series of the story of Cupid and Psyche, painted by Raphael, in the Farnesina at Rome. In the first apartment, he painted several beautiful compositions from the life of

Cupid; in the second, the Muses, and a grand composition of many figures, of Phaeton entreating Apollo to allow him to drive the chariot of the Sun; in the third, Diana surprised by Actæon, Diana detecting the pregnancy of Calisto, and the triumphs of Neptune and of Amphitrite. These works have been universally preferred to those of Le Brun; they have been engraved by Bernard Picart and others, in nineteen plates, and were published in Paris, in 1640, in folio, under the title 'Les Peintures de Charles Le Brun et d'Eustache le Sueur qui sont dans l'Hôtel du Chastelet, cy devant la Maison du Président Lambert, dessinées par Bernard Picart, et gravées tant par lui que par différens Graveurs.'

In 1655 Le Sueur's labours were terminated by his death, in the thirty-eighth year of his age; a constant excitement and an excessive application proved too much for a constitution naturally weak. Though he is reported to have been of a gentle and an amiable disposition, he had many enemies, but the report of his having been poisoned is without foundation; to be disliked by rivals, is the common lot of all men of extraordinary abilities. That Le Sueur's great talents engendered an active jealousy among his rivals, is generally allowed, especially upon the part of Le Brun, who is said to have openly expressed his satisfaction at the death of Le Sueur, saying, that he had been relieved of a great thorn from his foot. It cannot be doubted, that if Le Sueur had lived, the rising influence of Le Brun would have been seriously checked, and the French school of painting have taken ultimately a totally different course from that which it has pursued from the time of Louis XIV. until very late years. Although Le Sueur is now generally acknowledged to have been a great painter, during his lifetime his talents were never duly appreciated, nor was he ever employed on any public work; and though he was greatly superior to his more successful rivals, he would certainly have been a much greater painter had he had equal advantages with them. He never left Paris, he married very young, and being very badly paid for his works, he never had the means of travelling, or improving his taste by visiting Italy and studying the great works of its famous schools, or he would otherwise most probably have ranked with the greatest masters of Florence or of Rome. The defects of his style are, a deficiency in a thorough mastery of the naked figure, a feeble chiaroscuro, and a heavy and monotonous tone of colouring; some of his figures also want life, and appear to want purpose; in composition however, in character, and in the casting of draperies, he has seldom been surpassed; qualities foremost among the properties requisite to constitute a great painter.

When the Royal Academy of the Fine Arts was established in Paris, in 1648, Le Sueur was appointed one of the twelve antients or professors; he had been previously elected a member of the Academy of St. Luke at Rome. His style had no influence upon the arts in Paris; his only scholars were his three brothers, Pierre, Philippe, and Antoine Le Sueur, Le Fevre, and Nicolas Colombel. His own portrait, painted by himself, has been engraved by C. N. Cochin. In Landon's 'Ouvres de Le Sueur' there are 110 prints from his works.

(Felibien, *Entretiens sur les Vies et sur les Ouvrages des plus excellens Peintres, &c.*; D'Argenville, *Abrégé de la Vie des plus fameux Peintres*; Réveil and Duchesne, *Musée de Peinture et de Sculpture.*)

SUEZ, ISTHMUS OF, connects Africa with Asia, and separates the Mediterranean from the Red Sea. Its extent from north to south a little exceeds seventy-two miles. The most northern recess of the harbour of Suez, on the Red Sea, is hardly a mile south of 30° N. lat., and the village of Tyneh, on the Mediterranean, near the arm of the Nile, which in antient times was called the Pelusiac, and which at present is blocked up with sand, is only about two miles north of 31° N. lat. The advantages which would accrue to the commercial intercourse between Europe and the southern and eastern countries of Asia, from a canal navigable for large vessels being made across this isthmus, ...us, and it has been attempted several times. There ...e existed a canal on the isthmus, for numerous ...till appear in several places; it did not however ...vo seas, but only the Red Sea with the river ...anal was commenced when Egypt was an independent ...dom, under Necho, nearly 2500 years ago, and ...d by Darius. (Herod, ii. 157.) When the French, ...parte, had got possession of the country, they intended to give another direction to the commerce of Europe with India, by making a canal fit for large vessels across the isthmus; and accordingly they examined, with great care, the whole country between the two seas. A few years ago the idea was started of connecting the two seas by a railroad, and a company was formed in England for that purpose, but little or no progress seems to have been made in the execution of this scheme. The country does not present invincible obstacles to such an enterprise, as the following description, which is founded on the labours of the French engineers, clearly shows:—

one species ap... the accessory ... about four lines ... seas and those ... various fishes.

* Previously

The whole tract, from Suez to Tyneh, is uninhabited. and, in its present state, is uninhabitable. Drinkable water occurs only in one or two places, but as water has lately been found, by boring at the base of the mountains which lie to the west of the isthmus, and at no great distance from it, this inconvenience could be remedied by a short aqueduct from the wells to the line. It is very improbable that a canal could be made, owing to the want of water. The Red Sea is nearly thirty-three feet higher than the Mediterranean, and a canal would require locks; but the water of the whole isthmus would not be sufficient to feed one lock for a single day. A railway however could certainly be executed, as there is not one eminence along the whole line which deserves the name of a hill. The surface, in general, consists of sandstone, which in many places, by disintegration, has been converted into sand. The surface is not a level plain, but is interrupted by some considerable depressions, and these are covered with salt swamps or salt lakes. A depression of a somewhat different kind extends across the isthmus from Suez to Tyneh, not in a straight line, but diverging first to the west, and afterwards returning to the east, until it again reaches the straight line. In the southern part of this depression the canal of Necho had been made, and the French executed their levellings in the deepest part of it. By this levelling it was discovered that the depression, in nearly its whole extent, is lower than the level of the Red Sea. It is only the most southern extremity, between the arsenal in the harbour of Suez and the caravan-road leading from Cairo to Suez, a distance of 4½ English miles, which is higher than the level of the Red Sea at spring-tides, and in no part more than seven feet, though generally much less. The canal of Necho may easily be traced through this higher ground, and even where the country sinks below the level of the Red Sea such traces may be discovered as far as 30° 10′ N. lat., where they are lost in the deeper depression, which is filled by lakes, called the Bitter Lakes, from the taste of their waters. Up to these lakes the direction of the depression is due north, or nearly so, but the lakes themselves turn to the north-west, and extend to 30° 30′ N. lat. without interruption. The surface of the southern parts of the lakes is about 35 English feet below the level of the Red Sea, but in the northern parts a point was found which was 64 English feet below it. Not far from the northern extremity of the Bitter Lakes are the ruins of a temple of Serapis. The site of those ruins is less than two French feet below the Red Sea. At a short distance to the north of these ruins is another depression, containing a small lake called Temsah, which is dry during the greater part of the year, but filled with water when the inundations of the Nile have attained their greatest height. The water of the river reaches the lake by a depression in the stony ground, which bears the name of El Wadi. It is very narrow near the lake, but widens in proceeding westward to nearly a quarter of a mile, until, in approaching the small lake called Berket-el-Serigeh, it reaches the inhabited parts of the delta, and is nearly half a mile wide. Throughout this depression, which in some parts is nearly twenty French feet below the level of the Red Sea, the canal of Necho had been led, as appears from the numerous traces which still exist. In proceeding northward of Lake Temsah, and at no great distance from them, are some salt-marshes called Karfeh, which occupy a space of a few miles in length from north to south. West of these marshes the stony ground in some places was above the level of the Red Sea, and in others sinks some feet below it. Between the salt-marshes and the lake of Bellah is a similar stony country, of about the same elevation. The last-mentioned lake may be considered as the most southern branch of Lake Menzaleh, being united to it by low ground and marshes, which during the inundations of the Nile are covered with water. East of these two lakes is a stony

uneven tract, the surface of which never attains the elevation of the Red Sea, and this tract extends to 31° N. lat., where it joins the plain of Pelusium, which is nearly thirty feet below the spring-tides of the Red Sea, and about three feet above the level of the Mediterranean. The plain is a dead flat, with a sandy arid soil, almost entirely destitute of vegetation, and in many parts covered with a thin layer of salt. When the water attains its greatest height in the Nile, it is almost entirely inundated. At the eastern extremity of the plain is the small village of Tyneh, and about a mile to the south-west of it are a few ruins, which are supposed to be those of the antient town of Pelusium. But no traces of the bed of that arm of the Nile, the Pelusiac, the name of which was derived from that town, can be discovered in any part of the plain. The country which extends to the west of the line described is covered with horizontal strata of sandstone, and presents few inequalities, except towards the south, where, at the distance of about four miles from it, and south of 30° 20′, are the extremities of the ridges which lie between Cairo and Suez, and bear the names of Jebel Amed Taber, Jebel Ueybe, and Jebel Autad: an elevated hill, probably connected with Jebel Ueybe, occurs at a short distance from the western margin of the Bitter Lakes, and is the highest point of the isthmus. The country which lies to the east of the line is stony as far south as the south end of the Lake of Bellah on the north, and as far north as the caravan-road from Cairo to Suez on the south, but that part of the country which intervenes between these two points is entirely covered with sand.

SUEZ, a town situated at the head of the westernmost of the two arms or 'gulfs' in which the Red Sea terminates, is in 29° 57′ 30″ N. lat., 32° 31′ 33″ E. long., and 62½ geographical miles east from Cairo. Suez is situated on an angle of land between the broad head of the gulf, the shore of which here runs nearly from east to west, and the narrow arm which runs up northward from the eastern corner of the gulf. It is poorly walled on three sides, being open to the sea on the north-east, where is the harbour and a good quay. Within the walls are many open places, and several khans built around large courts. The houses are in general poorly built. There is a bazaar, or street of shops, tolerably furnished with goods from Cairo. The inhabitants are about 1200 Moslems and 150 Christians of the Greek church. The importance of Suez however arises from its position rather than its population, which can never be great. The transit of the productions and merchandise of the east from the Red Sea to the Nile has always made this an important station, and caused the existence of a city in the vicinity, though Suez itself as a town cannot be traced to an earlier origin than the early part of the sixteenth century. The concourse of pilgrims who annually embark here for Mecca has also rendered necessary a town at this station. The present arrangements for making it the point of communication between Europe and India, by means of steam-navigation on the Red Sea, may probably give an impulse to its prosperity and enlarge its population; but from the want of fresh water, and of every kind of verdure and cultivation, it can never become more than a place of passage, which both the traveller and the inhabitant will hasten to leave as soon as possible.

(Robinson's *Biblical Researches in Palestine:* Niebuhr's *Reisebeschreibung;* Burckhardt's *Travels in Syria, &c.*)

SUFFERANCE. [TENANT.]

SUFFICIENT REASON. (Mathematics and Physics.) The principle which is connected with these words might be, and frequently is, called the *want* of sufficient reason; and even this term may appear inaccurate, for it should be the want of *any possible amount* of reason. Since however all that takes place must have a sufficient reason (whether we know it or not) for its happening, and everything which is asserted must be capable, if true, of being shown to have a sufficient reason, there is no objection to our using the words 'want of sufficient reason' in the sense of absolute want of reason, in all matters connected with the exact sciences. If A be equal to B, there must not only be reason, but reason enough for it; anything short of reason enough is no reason at all, and anything short of proof enough is no proof at all.

The use of the word reason in the statement of this principle may itself be fairly objected to. We are in the habit of speaking of mathematical consequences in the same manner as of those to which the notion of cause and effect applies. When one proposition is made to subserve the proof of another, we call the first one of the reasons of the second, just as we should say that the reason of a flood was the preceding heavy rain. But this mode of speaking must be objectionable if the word reason be used in the same sense in both places. For, first, we are at liberty to deny the effect on denying that cause; if the rain had not fallen, the flood would not have taken place. But when we say that one mathematical proposition is the reason of another, in which position do we stand if we make an hypothetical denial of the first? Simply in that of persons who assert a contradiction of terms, and try to make rational consequences. Thus, the equality of the angles at the base of an isosceles triangle is one of the reasons (so called) why the tangent of a circle is at right angles to the radius; rationally, the first is one of the simpler propositions, the necessity of which, when seen, helps us to see the necessity of the second and more complicated one. But the necessity of the first is not previous to that of the second, except in the order of our perceptions, when we follow Euclid. Suppose we were to ask, if the angles at the base of the isosceles triangle had not been equal, what effect would that circumstance have had upon the position of the tangent of a circle? We might as well inquire, what would our geometry have been if two straight lines had been capable of inclosing a space? We remember a book of arithmetic in which it was gravely asked, by way of exercise for the student, 'If 6 had been the third part of 12, what would the quarter of 18 have been?' a question which can only be paralleled by 'If a thing were both to exist and not to exist at one and the same moment, how many other non-existences would therefore become existences?'

Secondly, the term reason, in the sense of previous cause, is wrong as applied to mathematical propositions, because when any one is made to prove the second, it generally happens that the second, when granted, may be made to prove the first. Thus [RIGHT ANGLE] of the two propositions, 'all right angles are equal,' and 'two lines which coincide between two points, coincide beyond them,' one must be assumed, and the other will then follow: but either may be the one assumed; the other will follow. Now it is absurd to say that of two things each is the previous cause of the other. The whole of this confusion may be remedied by any one who will remember that one proposition is not the cause of another, but it is our perception of the one which is made the instrument of bringing about our perception of the other. The constitution of our faculties is the previous cause of the necessity of mathematical propositions, but not of one before another, though in arriving at the perception of this necessity our cognizance of the necessity of one is made the previous cause of that of the necessity of another. To say that B is the consequence of A, is only to say that our knowledge of the truth of B is the consequence of our knowledge of that of A.

Taking care to use the word reason in the sense just alluded to, we assume that whatever is necessary has a possibility of being shown to be necessary, and that whatever is true has a possibility of being shown to be true. If this be a legitimate assumption, it then follows that whatever it is impossible to show to be true, must be false. But can there be such a thing as a proposition of which there shall be seen not its falsehood, but the impossibility of demonstrating its truth? Can there arise a case in which we shall be so completely cognizant of all that may possibly be said for or against an assertion, as to affirm a necessary incapability of demonstration of one side or the other? Such cases are universally admitted by mathematicians to exist; and the final assertion which is made on the known impossibility of proving a contradiction, is said to be made on the principle of the *want of sufficient reason.* But this very dangerous weapon is never put into the hands of a beginner, in mathematics at least. And when we call it a dangerous weapon, we do not deny its utility, but we only state what is well known to every mathematical teacher, that a student who is allowed to proceed one step by this principle will soon ask permission to make it the universal solvent of difficulties, and will be quite ready to urge that a proposition *cannot be shown to be false,* in preference to seeking for or following the demonstration that it *is true.* A beginner can easily admit a sound use of this principle, but can hardly distinguish it from the thousand inaccurate applications which his ignorance will make, if it be left in his own hands.

But we can imagine we hear it said that this principle,

though sometimes employed in pure physics, is never introduced into mathematical reasoning except *after direct demonstration*, in order to confirm the mind of the learner by making him see how difficult it would have been to imagine the possibility of any contradiction being successfully maintained against the proposition *just proved*. We believe indeed that this principle is seldom employed, and always without necessity, so that we could wish its use were entirely abandoned. But we can show that a tacit appeal to it is sometimes made; and this is the worst possible mode of employing it. If the principle be dangerous, and liable to be unsoundly used, it should be most carefully stated when it is used. Whenever we see a proposition assumed, not as an express postulate, but in a definition for instance, or as a self-evident truth, we may trace the operation of this principle on our minds. For instance, take the proposition which is, if there be such a thing in any one proposition, a digest of all the methods of mathematics, namely, that if the same operations be performed on equal magnitudes, the resulting magnitudes are equal. Try to imagine this not true, and want of sufficient reason interferes to prevent success. *What can make a difference?* In this question the principle claims to be applied.

Now, first, in examining the definitions of Euclid, we find an assertion of theorems which we can hardly suppose that Euclid overlooked, though it is very possible that the impossibility of imagining otherwise may have been his guide. For instance, the assertion of the equality of the two parts into which a diameter divides a circle, following immediately upon the definition of a circle; and the definition of equal solids as those which are contained by the same number of plane figures equal each to each. These and such little matters have been, or may be, corrected; but we will now point out a use of the principle which exists in our elementary works of the present day in an unacknowledged form.

In proving the celebrated proposition of Albert Girard relative to the dependence of the area of a spherical triangle upon the sum of its angles, it is assumed that two spherical triangles which have their sides and angles equal, each to each, are equal in area. Now it is easily shown [SYMMETRY] that there may be two such triangles of which it is impossible to make one coincide with the other, nor is any process ever given for dividing each into parts, so that the parts of one may be capable of coinciding with those of the other. Let the angular points of one be placed upon the angular points of the other (which is always possible), and the triangles will not coincide: in common language, they will *bulge* in different directions. When the triangles are so placed, and the common chords drawn, there is no difficulty in seeing that if ever a want of sufficient reason can be granted upon perception, it is for there being any inequality of the areas of the two triangles. And the equality of these areas is accordingly assumed: for instance, in the proposition above alluded to, a pair of unsymmetrically equal triangles always occurs, except when the given triangle is isosceles. Here again the appeal to this principle may be avoided; for it is easy to make the given triangles into the sum or difference of isosceles triangles, in which each of one set is capable of being actually applied to one of the other.

Leaving the subject of pure mathematics, let us now consider the application of this principle in physics. We have observed [STATICS] that the line of separation between pure mathematics and the more exact parts of mathematical physics is very slight indeed: this means as to the clearness and fewness of the first principles, and the rigour of the demonstrations. If we cut the link which ties the sciences of statics and dynamics to the properties of the matter which actually exists around us, we may go farther, and say that we have not only pure sciences, but pure sciences in which the principle of the want of sufficient reason is strictly applicable, because it is our own selves who have, by express hypothesis, excluded sufficient reason. In propositions of pure mathematics, we have seen that we cannot invent or deny for any hypothetical purpose; *is* and *must be*, *is not* and *cannot be*, are synonymes, in all the truths which these sciences teach. But the properties of matter which are not also those of space, are not, in our conceptions, necessary: we can imagine them other than they are, without any contradiction of ideas. We shall now proceed to consider the point mentioned in STATICS, namely, the character of the axioms of that science. Are they 'self-evidently true,' and 'not to be learnt from without, but from within?' We will not here inquire whether the first must be the second, not being sufficiently clear as to what is meant by knowledge 'from without' and knowledge 'from within' to enter upon any such investigation. It will do for our purpose to take knowledge 'from within' to be a phrase descriptive of such truths as that two straight lines cannot inclose a space, and knowledge 'from without' another phrase indicating such truths as are found, say in the facts of political history or geography. Let us separate from the rest one axiom of statics, say 'equal weights at the ends of equal arms of a horizontal straight lever balance one another.' First, 'equal weights' is a synonyme for equal and parallel pressures. We have no objection to placing the idea of pressure on the same footing as that of a straight line, for be the name we give the former conception what it may, it is probable that those powers of communication with the external world which are certainly necessary to the development, at least, of the former, are not less necessary to that of the latter. Nor are equal pressures difficult of definition; let them be those which are interchangeable, so that either may be put in the place of the other. The rest of the terms of the axiom are geometrical, and to balance each other is to produce no motion,—motion, independently of producing causes, being, we think, as much an idea of geometry as any other. Let A and B be the two ends of the lever (a rigid bar without weight), and C its middle point, which is the pivot; that is to say, the middle point cannot move, the only possible motion of the lever being revolution, in the plane of the pressures, about that middle point. On these hypotheses, we may certainly say that the axiom is self-evident, for want of sufficient reason, that is, of a possibility of sufficient reason for anything in contradiction of it. We have, before the pressures are applied, no cause of motion, by hypothesis: we are to conceive a lever which, if it move at all, does so by reason of the pressures. We have made these pressures equal, and applied them symmetrically: there is then, and can be, no reason why one should predominate, which does not hold as much of the other. In the very notion of equality of pressures there is interchangeability; that is, each may be substituted for the other without alteration of effect. Suppose then the left-hand pressure to predominate: it will do so if the pressures be interchanged. But after the interchange, the same reasons which made the left hand predominate will make the right hand predominate: or both ends will move in the direction of the pressures, which is impossible.

We believe the preceding to be as legitimate a use as can be made of the sufficient-reason principle: but before statics can be established on axioms, there is another of them required, which we have never been able to satisfy ourselves comes 'from within.' It must be assumed that the pressure on the pivot is equal to the sum of the pressures on the ends, whatever the length of the arms may be: this we believe *we learn* from existing matter in quite a different sense from that in which we speak when we say that we learn the conception of pressure or of a straight line from our communication with the external world by our senses: to us it more resembles the assertion that the sea is salt, or that a horse has four legs. It certainly does not arise from the sufficient-reason principle; for there is a reason why difference of pressures on the pivots may arise in levers which only differ in the arms, namely, that very difference of the arms. In fact, there is a presumption against the truth of the proposition *à priori*, derived from a principle the frequent and usual truth of which may as well be called knowledge 'from within' as the conception of pressure or of a straight line: this principle is, 'differences generally make differences, but not necessarily.' The beginner in geometry has this in his mind when he feels that he has learnt something in finding out that the sum of the angles of a triangle is always the same, whatever the triangle may be: he would have expected it to be otherwise. Triangles of different sides have generally different areas, different perpendiculars, different inscribed and circumscribed circles, and different angles: why not different sums of angles? In truth it is a constant and latent assumption throughout the exact sciences that 'differences are to be supposed to make differences, except where the contrary is proved.' And the assumption that the pressure on the pivot of a lever is independent of the arms, is either in defiance of this general principle, or a result of experience.

Thinking then that the sciences of pure mechanics can be founded upon few and incontrovertible postulates, in such

a manner as to entitle them to the name of pure sciences, or some other which shall mark the real distinction between them and the other sciences of matter, we cannot yet be of opinion that their postulates are all derived from their own evidence, or obtainable from the sufficient-reason principle. There are however many points connected with this part of them which are difficult of exposition for want of acknowledged terms.

SUFFIX, a term lately employed in mathematical language to denote the indices which are written under letters, as in a_0, a_1, a_2, a_3, &c. Though these signs have been so long used, we never saw a distinctive name given to them before the publication of Professor Hall's Differential Calculus.

SUFFOLK, a maritime county of England, on the east coast. It is bounded on the north by the county of Norfolk, from which it is in almost every part separated by the rivers Little Ouse, Waveney, and Yare; on the east by the German Ocean; on the south by the county of Essex, from which it is in almost every part separated by the river Stour; and on the west by Cambridgeshire, from which it is, for a short distance, separated by the river Lark, a feeder of the Great Ouse. The general form of the county approximates to that of a crescent, of which the whole of the concave side is conterminous with the county of Norfolk. The approximation to the crescent shape would be greater but for the elongation of the south-western part about Haverhill, where the boundary forms an acute angle, and for a second projecting portion near Newmarket. The greatest length is from north east to south-west, from Southtown, a suburb of Great Yarmouth, to the neighbourhood of Haverhill, 68 miles; the greatest breadth, nearly at right angles to the length, is from the bank of the Little Ouse, in the north-west corner of the county, to Landguard Fort, opposite Harwich, 52 miles. The area of the county is estimated at 1515 square miles, or, taking the aggregate of the parochial surveys, 918,760 acres; the population, at the different enumerations, from 1801 to 1841, was as follows:—1801, 210,431; 1811, 234,211, increase 11 per cent.; 1821, 270,542, increase 15 per cent.; 1831, 296,317, increase 9 per cent.; 1841, 315,129, increase 6·3 per cent. The census of 1831 (which we retain to facilitate comparison with other counties, in which we have employed it) gave 196 inhabitants to a square mile. This county is in size the twelfth of English counties, being smaller than Cumberland, but larger than Sussex; in amount of population (1831) it was the seventeenth, its place being below Cornwall, but above Sussex; and in density of population the twenty-third, falling short of Monmouthshire, but exceeding Hampshire in this respect. There are two county-towns. Ipswich is 63 miles in a direct line north-east of the General Post-office, London, or 70 miles by the mail-road through Romford, Chelmsford, Witham, and Colchester; Bury St. Edmunds is 62 miles in a direct line, north-east by north, from the same point, or 76 by the mail-road through Bishop's Stortford and Newmarket. The county is included between 51° 55′ and 52° 38′ N. lat., and 22′ and 1° 46′ E. long.

Surface; Coast-Line; Geology.—The surface of this county is gently undulating, except just along the north-western and some parts of the north-eastern border, where the land subsides into a marshy flat, secured from overflow only by embanking the course of the rivers. There are also some marshes bordering the rivers in the south-eastern part, but none of these are of any extent. There is not an eminence in the county worthy of notice. The highest ground, as determined by the course of the waters, forms a ridge of crescent-like shape, corresponding with that of the county, through the centre of which it extends. It may be indicated by a line drawn from the neighbourhood of Lowestoffe in the north-east, between Bungay and Halesworth, to the neighbourhood of Debenham; and from thence to the western border of the county, passing between Stowmarket and Ixworth, between Bury and Lavenham, and between Newmarket and Clare. The waters which flow northward from this line fall into the Waveney or the Ouse; while those which flow southward join the Stour, the Orwell, the Deben, or other streams flowing into the German Ocean.

The coast has a tolerably regular outline, convex to the sea. The bays are shallow, and the headlands have little prominence. The maps notice three bays: Hollesley Bay, between the point at Bowdsey, near the mouth of the Deben and Orford Ness; Aldeburgh or Aldborough Bay, between Orford Ness and the headland near the village of Thorpe; and Southwold or Sole Bay, between Thorpe Point and Easton Ness, north of Southwold. This last has some historical interest as the scene of a severe but indecisive conflict between the Dutch and English fleets (A.D 1672). The headlands are the point on which Landguard Fort is placed, at the entrance of the æstuary of the Orwell and the Stour, opposite Harwich; the point at Bowdsey; Orford Ness, near Orford; the point near Thorpe; Easton Ness; and Lowestoffe Ness, the most easterly point in Great Britain. The harbours are the æstuaries of the rivers Stour and Orwell, Deben, Butley or Alde, Blyth and Yare, and the artificial cut through lake Lothing into the Waveney. The æstuary of the Stour and the Orwell is for the most part lined with marshes, which however do not in any part extend more than a quarter of a mile inland from the banks of those rivers, except just above Landguard Fort.

The sea-shore from Landguard Fort is lined for about two miles with sand-hills, and from thence for two miles, nearly to the æstuary of the Deben, by low cliffs of crag upon blue clay. Beyond the æstuary of the Deben (which is skirted by a narrow line of marsh-land) cliffs of similar formation to those just mentioned recommence, and extend nearly three miles to the point at Bowdsey. The shore of Hollesley Bay, from the point at Bowdsey to Orford Ness, eight miles, is low, lined as far as the æstuary of the Butley or Alde with marshes, and north of that æstuary by beach or shingle, which continues to line Aldeburgh Bay, as far as the town of Aldeburgh, four miles, and separates from the sea the marshes formed by the Alde, which has the lower part of its course parallel to the coast-line, and very near it. From Aldeburgh the coast continues to be low for seven miles, and then rises into cliffs, near Dunwich, of rounded shingle and sand. These cliffs extend about two miles to Dunwich, where the low shore recommences, and extends four miles to Southwold. From Southwold, with two or three short intervals, in which the shore is low, a line of cliffs, consisting for the most part of sand or chalk rubble covering gravel and red loam, extends eighteen or nineteen miles to the mouth of the Yare, where the coast of the county terminates. The whole length of the coast may be estimated at above fifty miles.

The greater part of the county is covered by diluvial beds. The exceptions are the crag and London clay district of the south-east, and the chalk district of the north-west. The crag and London clay district may be considered as bounded by a line drawn from Orford by Woodbridge and Ipswich to the banks of the Stour, between Sudbury and Nayland. The chalk is all found to the north-west of a line drawn from Euston, near Thetford, to Bury St. Edmunds, and from thence west by south to the border of the county. The chalk does not wholly occupy this district, but rises from beneath the diluvial beds, or from beneath the fens which occupy the north-western extremity of the county. These diluvial beds vary in their character. In the centre of the county, between a line drawn through Sudbury, Lavenham, Stow-Market, and Diss (in Norfolk), on the west, and another line drawn through Ipswich, Debenham, and Harleston (in Norfolk), on the east, they consist of beds of clay, with fragments of chalk. Eastward of this, beds of loam, with fragments of chalk, extend nearly to the shore, along which they are, in many parts, covered with sand, or gravel, or shingle, or chalk rubble. A similar loam is found bordering the clay on the west side for some distance, and extending south-west of Bury St. Edmunds to the very border of the county. Beyond this, on the north-west, are found beds of sand, with or without flint gravel.

The crag formation consists chiefly of thin layers of quartzose sand and comminuted shells, resting sometimes on chalk, sometimes on the London clay. Crag is a local name for gravel. Close examination has led to the subdivision of this deposit into the red crag and the coralline crag, the former being uppermost when the two are found together. The red crag is at once distinguishable from the coralline by the deep red ferruginous or ochreous colour of its sands and fossils. The fossil testacea found in the crag, amounting to upwards of 400 species, are some of them common to both divisions; others are peculiar to one division, and characteristic of it. These fossils bear a general analogy to testaceous animals now existing in the northern seas, between lat. 50° and 60°; but whether any are identical with those now found in the adjacent (German) ocean is matter of dispute. Lyell refers the crag formations to the Older Pliocene period. The thickness of the crag is not

known: it has been penetrated 50 feet near Orford without reaching the bottom.

It is probable that the London clay occupies the whole district which we have assigned to it and the crag; and that the latter covers it in that part of the district which lies north-east of the Orwell. That part of the district which lies between the Orwell and the Stour is for the most part occupied by the London clay alone.

The chalk of the north-western side of the county does not rise into high hills; the formation appears to extend under the diluvial beds which occupy the centre of the county. (Conybeare and Phillips's *Outlines of the Geology of England and Wales*; Lyell's *Elements of Geology*.)

Suffolk produces scarcely any minerals of value. Clay and shell-marl from the crag formation have been dug for manures.

Hydrography and Communications.—The Waveney and the Little Ouse, border rivers, which separate this county from Norfolk, and receive the drainage of the northern part, are described elsewhere [NORFOLK, vol. xvi., p. 258-9]: where also the navigable cut from the sea, through lake Lothing, is described, though it belongs to Suffolk. The tributaries of the Waveney are all small. The longest, which rises about two miles east of the village of Mendlesham, and flows by the borough of Eye into the Waveney at Hoxne, is only 10 or 12 miles long. In that part of the county which is adjacent to the lower part of the course of the Waveney are several small sheets of water, as Oulton Broad and lake Lothing, through which the navigable cut passes, and which, together, are above two miles long from east to west; Breydon Water, above three miles long, just below the junction of the Waveney and the Yare, on the border of the county; Fritton decoy, a winding sheet above two miles long; and Flixton decoy, which is much smaller. None of these pieces of water have much breadth, except Breydon, and that, in its widest part, is not a mile across.

The Little Ouse receives only one stream which requires notice. It rises near Bradfield St. Clare, about five miles south-east of Bury St. Edmunds, and flows by Ixworth and Euston park into the Little Ouse above Thetford. Its length may be estimated at 16 or 18 miles. The river Lark, a tributary of the Greater Ouse, rises at Lawshall, five or six miles south of Bury St. Edmunds, flows northward to that town, where it receives a little stream called the Linnet, and then flows north-west, by Mildenhall, to the border of the county, which it skirts for a few miles, and then enters Cambridgeshire, where it joins the Greater Ouse. Its whole length may be estimated at about 30 miles. It is navigable from Bury, and serves to convey produce from that town and neighbourhood to the river Ouse and the port of Lynn.

Of the streams which drain the southern part of the county, the Stour is the most important. It divides Suffolk from Essex, and is described elsewhere. [ESSEX, vol. x., p. 17.] The Stour receives many tributaries: a stream 10 miles long from the neighbourhood of the village of Wickham Brook, and another rather longer from the village of Reed, join it near Long Melford, a little above Sudbury; and the Bret, 23 miles long, from Thorpe Green, near the village of Thorpe Morieux, flows first south-east and then south by Lavenham and Hadleigh into the Stour near Stratford, on the road between Colchester and Ipswich. None of these tributaries are navigable.

The Orwell, or Gipping, as it is called in the upper part of its course, is formed by the junction of several streams, which unite just by Stow-Market, and flows south-east by Needham-Market to Ipswich. Below that town it expands into an æstuary of considerable width, which unites at Harwich with the æstuary of the Stour. It is the æstuary alone which bears the name of Orwell. The course of this river to Ipswich is above 20 miles, for more than half of which (viz. from Stow-Market) it is navigable: the æstuary is 10 or 12 miles long, and for the greater part of that distance more than half a mile wide at high-water. Sea-borne vessels of considerable burden get up to Ipswich. Ipswich, antiently written Gypeswic, Gippeswic, Gipeswich, and Ypeswich, obviously includes in its name the same element as the name Gipping.

The Deben rises near Debenham, and flows about 20 miles in a winding course to Woodbridge, below which it becomes an æstuary 9 or 10 miles long, and from a quarter to half a mile wide, navigable for sea-borne vessels of considerable burden.

The Alde rises near the village of Brundish, and runs 11 miles south-east to its junction with the Ore, which rises near Framlingham, and has an eastward course of about 12 miles. From the junction the united stream, which is sometimes called Ore, sometimes Alde, flows about 15 miles into the sea. The course of this part of the river (which is, for the greater part of its length, an æstuary) is remarkable: about eight miles below the junction of the Alde and the Ore, near the town of Aldeburgh, it approaches within 200 yards of the sea; and then turning suddenly, has the rest of its course nearly parallel to the shore, from which it is separated by a long, narrow, marshy peninsula. The principal feeder of the Alde is the Butley, a small river, the lower part of which becomes a tolerably wide æstuary, opening into the æstuary of the Alde just before it joins the sea. The Alde is navigable to Snape Bridge, near the head of the tideway. The part below the junction of the Butley is sometimes called Butley.

The Blyth rises near Laxfield, and flows eastward 16 miles by the neighbourhood of Halesworth, from which town it receives a small feeder, into the sea near Southwold: it is navigable up to Halesworth, eight or nine miles.

There are no canals, but some of the smaller rivers have been made navigable.

The Norwich and Ipswich mail-road enters the county at Stratford Bridge over the Stour, between Colchester and Ipswich, and runs to Ipswich, and from thence northward by Stoke and Scole Bridge over the Waveney into the county of Norfolk. It is remarkable that this road does not pass through a single market-town between Ipswich and Norwich, a distance of 43 miles, though passing through a fertile and cultivated country. The Yarmouth mail-road branches from the Norwich road at Ipswich, and runs through Woodbridge, Saxmundham, and Lowestoffe. A second Yarmouth road branching from this at Blythburg, between Saxmundham and Lowestoffe, passes through Beccles, and rejoins the mail-road just before entering Yarmouth. The Norwich and Newmarket mail-road enters the county at Newmarket, runs eastward to Bury St. Edmunds, and then northward to Thetford in Norfolk. The distance to Norwich is lessened by following the road which leads from Newmarket to Thetford through Barton Mills. Another road to Norwich enters the county at Sudbury, and runs by Long Melford to Bury, and from thence by Ixworth and Botesdale to the Norwich and Ipswich mail-road at Scole. A road from Bury leads by Stow-Market and Needham-Market to Ipswich. The roads in all parts of the county are excellent.

The Eastern Counties Railway will cross the county in nearly the same direction as the Norwich and Ipswich mail-road, and not far from it. It runs for the most part on the east or right side of the road, at a distance varying from a quarter of a mile to four miles.

Agriculture.—The county of Suffolk is peculiarly interesting in an agricultural point of view; and, with the adjoining counties of Norfolk and Essex, it forms one of the best cultivated districts in the southern part of Great Britain.

The climate is much drier than that of the more western counties of England; but also colder in spring, when the north-easterly winds prevail. The only inconvenience arising from this is the occasional freezing of the turnips, when left on the ground; but the beneficial effects of a sharp dry air on the land, which has been ploughed up before winter, fully compensate for the occasional loss of turnips and the slow progress of early feed. The soil, although varying extremely, may be divided into three or four distinct kinds. A very rich loam, chiefly alluvial, is found in a small portion of the southern part of the county, between the Orwell and the Stour, both of which rivers form æstuaries at their junction with the sea at Harwich. This loam is not so compact as clay, nor so loose as sand, but contains a great proportion of organic matter, or whatever else constitutes a very fertile soil. Of this kind of soil it is supposed, in the Report made to the Board of Agriculture, that there may be about 46,000 acres. The next class consists of heavier loams, varying in every degree, but in general resting on an impervious soil of marl or clay, and in most situations requiring the assistance of drains to carry off superfluous water. This soil is found in the whole of the centre of the county, from the Stour to the borders of Norfolk, and is computed at 450,000 acres, being nearly half the surface of the whole county. Between the strong loam and the sea is a strip running from the north bank of the river Orwell to Yar-

mouth, diminishing in breadth as it stretches northward, and consisting chiefly of sand of various qualities, incumbent on a subsoil of crag, which is a loose rocky substance, composed of sand, gravel, and broken shells, partly consolidated into a kind of stone. Some of this sand is poor, and scarcely worth cultivating; but a great part of it is enriched by organic matter intimately mixed with it: this is excellent for roots, especially carrots, and bears very fine barley. In the portions which lie low, and which have at some time or other been covered with water, a very rich mud has been deposited, and has produced as rich a soil as may be desired. These rich portions however are few in comparison to the whole tract, which altogether contains about 150,000 acres. There is another tract of sand of a much inferior quality on the western extremity of the county, extending from Bury St. Edmunds to Thetford, with some better lands interspersed. This lies chiefly on a chalk bottom, and is scarcely thought worth cultivating. Where it has been improved, so as to become productive, it has been done at a very considerable expense in draining, trenching, and marling. There may be in this district about 100,000 acres of this poor sand, with 10,000 of a better quality. The last class consists of the fen-lands, which, when properly drained, become valuable; but in their natural state, soaked in water, they are of little value. The extent of fen is estimated at 30,000 acres.

The system of tillage is very uniform throughout the county. The greater part of the land is under the plough. There is now scarcely such a thing to be seen as a common field: a complete bar was formerly opposed to any improved mode of cultivation by the absurd rules and restrictions as to cropping which were established in consequence of the joint and several rights over the land, which no longer exist since the common fields have been divided and enclosed. The practice of ploughing the stubble immediately after harvest, and giving it the full benefit of the alternations of rain and frost which mark the variable climate of Great Britain and Ireland, is adopted on all kinds of soils. Wherever turnips can be profitably raised, and safely fed off with sheep, they form the basis of all rotations. Where the land is too strong and adhesive for turnips, and where sheep would do harm by their treading, and where the carts and horses would do equal damage in taking them off, a fallow is substituted: this however is not the old fallow preparatory to a crop of wheat, but it is the *long fallow*, in which the land is exposed to the influence of two winters. Barley and clover are sown in the spring of the second year, to be succeeded by wheat and beans. This long fallow has been mentioned before. [Essex, *Agriculture*.] We shall only observe that it was suggested by the failure of the turnips when it was attempted to sow them on very strong soils. To prevent the land being overrun with weeds, the natural concomitant of a failing crop, it was ploughed in summer and again in autumn; and as the sowing of wheat without any manure, and out of course, was not approved of, it was left to come in for barley with the lighter lands which had borne turnips. Much to the surprise of those who first adopted this plan, almost from necessity, they found that their barley was more abundant and of a better quality after the long fallow, *without manure*, than upon those fields which had borne turnips, and on which sheep had been folded. Nothing was lost therefore but the value of the turnips when fed off, which in many years is trifling. The clover ley being manured in the succeeding autumn, a good crop of wheat might be depended upon. Thus three valuable crops were reaped in four years, barley, clover, and wheat; and, where the land was in good heart, a crop of beans could be obtained, without risk, either after the clover or after the wheat, usually the latter, before another fallow, giving four crops in five years. We are not aware that this mode of cropping stiff clay-lands is adopted in any part of England, except the three counties of Essex, Suffolk, and Norfolk, and perhaps in a part of Cambridgeshire adjoining these counties; but all the practical farmers who have adopted it have found their advantage in continuing the long fallow on stubborn clays.

On turnip land the four-course shift, as it is called, is universal, with some deviation as to the recurrence of clover every fourth year, a portion of the land being laid down with grass-seeds or Italian rye-grass, or planted with beans or peas, according to the nature of the soil. The simple Norfolk rotation is however on the whole the most profitable, and by means of deep ploughing, which is but partially introduced, clover is found to succeed for a considerable period every fourth year. When any deficiency appears, recourse must be had to some substitute, so as to defer it to every sixth or eighth year. The subsoil plough is of great assistance in securing a crop of clover.

There is no part of England where the implements of husbandry are more perfect than in Suffolk, or where new implements are tried with more readiness and with less prejudice. This is owing in a great measure to the very excellent manufacturers of agricultural implements who live in the county. The competition among these men, many of whom possess great capital, tends to the detection of every defect, and ingenuity is stretched to make improvements both on the form and the durability of implements.

The ploughs almost universally used, whether with or without wheels, are of cast-iron, except the beam and the stilts; each part admits of separate renewal at a moderate expense, being cast on one pattern and attached with nuts and screws. The wheel-ploughs are preferred by the ploughmen, because they require less attention and are easier to hold; for a boy can hold a wheel-plough who would make but sorry work with the best swing-plough. The question of comparative draft, which is at this moment in dispute between the Royal Agricultural Society and the Highland Society of Scotland, it would be presumptuous to decide; but perhaps it will be found that in some cases wheels are convenient and save labour both to man and horse, while in others a good swing-plough in the hand of a skilful ploughman will plough a greater variety of land in a more complete manner, without any distress to the horses.

It would be superfluous to enumerate all the different improved instruments which are in use in a large Suffolk farm: it would comprise a complete catalogue of scufflers, scarifiers, rollers, and harrows, which assist the plough in preparing the land; of drilling-machines to deposit the seed; of threshing machines, winnowers, hummellers, &c. to prepare the grain for the market; of machines for cutting roots or straw, or bruising oil-cake for cattle, or bones for manuring the land. Nowhere is so great a variety of farm-machines used for saving labour.

Many of the farm-buildings which have been erected of late years are not only commodious, but splendid. On the older farms there may be some deficiency, but the habitations of the farmers in general are such as many squires of the last century would not have disdained to live in; many in fact are old mansions. The barns are not so large or so numerous as they used to be before the mode of stacking corn out of doors was so generally adopted. Where a threshing-machine is erected, a single floor is sufficient for a large farm; and if the bays will hold one stack at a time, there is stowage enough for corn. The yards, on the other hand, are much increased and better arranged; where there is not sufficient shelter by walls and sheds, this is supplied by what are called *halm-walls*. [Harvest.] The stubble (*halm*) which has been raked off the land after harvest, is stacked in the farm-yard in such a manner as to enclose a space, leaving an opening only sufficient to admit a loaded waggon. A small square is thus enclosed, and the cattle are sheltered from cold winds. The wall is made ten or twelve feet high, and ten or twelve feet wide at the bottom. This great width is necessary to resist high winds and the rubbing of the cattle. The top is roughly thatched. When, by the rubbing of the cattle and the decay of the stubble, the wall becomes loose and unsteady, it is taken down, and spread over the farm-yard as litter, and a new wall built. These halm-walls last several years. Nowhere are stacks of corn more neatly built than in Suffolk. As many as are intended to be kept for any length of time are built on frames, called *staddles*, supported by stone or iron pillars about eighteen inches from the ground, with flat caps over the pillars to prevent the access of rats and mice. The sides of the stacks are cut smooth by a sharp knife, such as is used for cutting trusses of hay, and thus the depredations of birds are prevented, and nothing is lost. When barley is stacked, which is generally on the ground in a dry spot, it is protected by a slight coat of thatch all round down to the ground. This is fixed by means of rods and pins, and protects the outer layer of barley. It is thus not only preserved from birds, but also from the effects of the weather, and the sample has none of those discoloured grains which deteriorate the value, but is equally clear and bright with the interior of the stack, if the barley has not been hurt in the field.

The practice of dibbling corn by hand is adopted, as far as the number of hands permit; but on a large farm it is

too slow an operation; the drill is therefore generally used, which will in one day sow ten acres of land. Machines for dibbling have been invented, and no less than four patents have been obtained lately for such inventions [SOWING MACHINES], but they have not yet been sufficiently tested by experience to be generally adopted.

Suffolk has but one breed of cattle which is peculiar to it. It is a polled breed, of which the cows are in great repute, and justly so. It is supposed that this breed has some relation to the Galloway and Aberdeen polled breeds; but this is mere conjecture. The cows are usually of a light red, sometimes spotted with white, of moderate size, and excellent milkers. The oxen have not been much attended to, as most of the bull-calves are fatted for the butchers or sent towards Essex and London for that purpose. Their aptitude to fatten has seldom been noticed; but the Suffolk cows, when barren, fatten well. A Suffolk cow has been known to give 30 quarts of milk per day, and of a good quality, for a considerable time after calving; but this is, no doubt, an extraordinary instance. Twenty quarts per day for three months is by no means uncommon, and sixteen may be considered as an average. This will give seven pints of butter, twenty ounces to the pint, per week—no bad produce.

The Suffolk farm-horses are noted for their docility, steadiness, and unwearied perseverance against a dead pull. In former days it was not unusual in fairs and markets to hook the traces of a horse to a ring in a post fixed into the ground. If the horse pulled till he went down on his knees, he was staunch; but if he ever refused his utmost exertions, he was despised. No better mode could be invented to spoil a good horse. The truly-bred Suffolk horses are active in their walk, which is their best pace. It is not easy for a man to keep pace with a Suffolk horse walking along the road. They step out well, and some of them can go at the rate of three miles an hour drawing a plough, and to this is owing the quantity of land usually ploughed in one day in the lighter lands of Suffolk and Norfolk. The usual mode is, as in Scotland, in two yokings, resting two or three hours between, in summer. The defect of the Suffolk horses, if it be any for a farm-horse, is to have rather coarse heads and very wide hips. Some of them are exceptions, and show fine proportions; and many a Suffolk mare has been put to a thorough-bred horse, and produced very fine foals for the carriage or the chase. But those who would try this cross should be very careful to select mares with fine heads, good shoulders, and not a falling croup. In spite of all precautions, the old points will come out, and occasionally spoil a very promising foal, even at the third or fourth generation.

Suffolk pigs are perhaps, on the whole, the most profitable breed in England. They are well-shaped, short-legged, mostly white, with short upright ears, and the porkers of this breed are excellent. It may be distinguished from the Essex breed by being better covered with hair, and from the Norfolk by having smaller ears set more nearly together. It is difficult to trace the crosses of so prolific an animal as a pig; but while the Essex have evidently much Neapolitan blood, the Suffolk seem to have more Chinese. Both crosses being excellent, it is useless to dispute the pre-eminence. The Suffolk pig is not so delicate in constitution as the Essex, and is therefore decidedly the best poor man's pig.

Suffolk has no indigenous breed of sheep; the Southdown and a cross of this breed with the Leicester and Cotswold are very common. The cross between the Southdown and Norfolk is increasing in reputation. The horns of the Norfolk sheep and his rambling propensities have been changed, and a quiet polled breed is the result. They are well shaped; and the mutton, if old enough, is excellent. They are getting more and more into favour.

The principal fairs in Suffolk are as follows:—Aldborough, Mar. 1, May 3; Beccles, Mond. in Whits. week; Bildestone, Ash Wed., Ascension-day; Botesdale, Holy Thursd., three weeks after Michaelmas-day; Boxford, Easter Mond., Dec. 21; Brandon, Feb. 14, June 11, Nov. 11; Bungay, May 14, Sept. 25; Bures, Holy Thurs.; Bury St. Edmunds, Tues. in Easter week and two following days, Oct. 2, Dec. 1; Clare, Tuesd. in Easter week, July 26; Debenham, June 24, Aug. 8; Eye, May 30; Framlingham, Whit Mond., Oct. 10; Hadleigh, Tuesd. in Whits. week, Oct. 10; Halesworth, Oct. 29; Haverhill, May 12, Aug. 26; Ipswich, May 4, Aug. 26, Sept. 25; Ixworth, May 13; Lavenham, Oct. 10, for four days; Shrove Tuesd.; Long-Melford, Tuesd. in Whits. week; Lowestoffe, May 12, Oct. 10; Mendlesham, Oct. 2; Mildenhall, Oct. 11; Nayland, Wed. after Oct. 2; Needham-Market, Oct. 28 and two following days; Orford, Mids.-day, Shrove Tuesd.; Saxmundham, Tuesd. in Whits. week, 1st Thurs. in Oct.; Southwold, Trin. Mond.; Stowmarket, July 10, Aug. 12, Oct. 1; Sudbury, Mar. 12, July 10, Sept. 4; Woodbridge, April 6.

Divisions, Towns, &c.—The county is divided into twenty-one hundreds, as follows, besides the liberty of the borough of Ipswich:—

Hundred.	Situation.	Area. Acres.	Population 1831.
Babergh	SW.	69,630	28,355
Blackbourn	N.	67,370	14,267
Blything	E.	83,850	24,177
Bosmere & Claydon	Central	50,640	12,956
Carlford	do.	22,550	6,348
Colneis	SE.	17,460	4,369
Cosford	Central	30,640	10,489
Hartismere	N.	55,240	17,871
Hoxne	N.	53,070	16,399
Ipswich (liberty)	SE.	7,020	20,201
Lackford	NW.	79,800	13,109
Loes	Central	33,290	13,544
Mutford and Lothingland	NE.	32,960	15,255
Plomesgate	E.	41,390	11,285
Risbridge	W.	59,160	16,215
Samford	S.	44,620	11,242
Stow	Central	22,010	8,308
Thedwestry	do.	39,820	10,103
Thingoe	do.	34,890	17,458
Thredling	do.	7,630	3,328
Wangford	N.	35,510	13,605
Wilford	SE.	30,180	7,433
Total	. .	918,760	296,317

The boroughs of Bury St. Edmunds and Sudbury are included respectively in Thingoe and Babergh hundreds.

Suffolk contains the two county and borough towns of Ipswich and Bury St. Edmunds, the parliamentary boroughs of Sudbury and Eye, the ex-parliamentary boroughs of Aldborough or Aldeburgh, Dunwich, and Orford: and the market-towns of Beccles, Bungay, Clare, Debenham, Framlingham, Hadleigh, Halesworth, Lavenham, Lowestoffe, Mildenhall, Newmarket, Saxmundham, Southwold, Stowmarket, and Woodbridge; with the ex-market towns of Bildesdon, Blythburgh, Botesdale, Brandon, Haverhill, Ixworth, Mendlesham, Needham-Market, Neyland, and Woolpit. Some of these are noticed elsewhere. [ALDBOROUGH; BECCLES; BUNGAY; BURY ST. EDMUNDS; IPSWICH; NEWMARKET.] Of the rest we subjoin an account.

Sudbury, in the Saxon chronicle Suth-beri, is in the hundred of Babergh, on the road from London to Bury, between 15 and 16 miles south of the latter town. It was anciently a place of consequence, and appears to have obtained its name to distinguish it from Bury St. Edmunds. It was one of the seats of the woollen manufacture established in England by the Flemings, in the reign of Edward III. Simon of Sudbury, archbishop of Canterbury, who was beheaded by Wat Tyler's mob, A.D. 1381, founded here a college of priests, whose yearly revenues at the dissolution were 122*l.* 18*s.* 3*d.* There were also a house of Dominican or Black Friars, a Benedictine cell to Westminster Abbey, and an hospital. The head and body of archbishop Simon of Sudbury were buried in the church of St. Gregory in the town; and the head, dried by art, was shown as late as the middle of the last century. The borough comprehends three parishes, All Saints, St. Gregory, and St. Peter; these have an area of 1250 acres; the population in 1831, was 4677. By the Boundary Act, the township of Ballingdon-cum-Brunden (in Hinckford hundred, in Essex, area 730 acres, population in 1831, 823), and some small extra-parochial districts, were added to the borough for parliamentary purposes, and the limits thus extended have been adopted for municipal purposes also. The town consists of several streets, irregularly laid out; it is a neat, clean, well-built place; the streets are paved, with flagged footpaths, and lighted. Many new houses have been built, and the town has been altogether much improved of late years. Ballingdon has one street, forming a suburb of Sudbury, with which it is united by a bridge over the Stour. The three churches are mostly of perpendicular character: they have all been fine churches, but some of the tracery and other parts have

been much mutilated. The Independents have a meeting-house. The town-hall is a modern building, and there is a neat theatre. The principal manufacture is of silk. By means of the Stour, which is navigable nearly up to the town for barges, trade is carried on in coals, which are imported, and in agricultural produce, which is exported. The navigation however is very bad. The market is on Saturday, and there is beside a corn-market on Thursday; there are two yearly fairs.

According to the census of 1831, 269 men in the borough and 5 men in Ballingdon, together 274 men, were employed in manufactures, besides women and children. The living of All Saints is a vicarage, of the clear yearly value of 119*l.*, with a glebe-house; the perpetual curacies of St. Gregory and St. Peter are united; their joint yearly value is 160*l.*, with a glebe-house. They are in the rural deanery and archdeaconry of Sudbury and diocese of Ely. There were in the borough, in 1833, eight day-schools, of all kinds, with 365 children, viz. 232 boys, 117 girls, and 16 children of sex not stated; and two Sunday-schools, with 233 children, viz. 120 boys and 113 girls. Two of the day-schools were national schools, and were attended on Sunday by 382 children, viz. 180 boys and 202 girls. Sudbury was incorporated by charter of Queen Mary, A.D. 1554. By the Municipal Reform Act it has 4 aldermen and 12 councillors, with a commission of the peace. It returns two members to parliament; the number of voters on the register in 1835-6 was 578; in 1839-40, 594.

Archbishop Simon of Sudbury, Gainsborough the painter, and Dr. Enfield, a dissenting minister of considerable note, were born at Sudbury.

Eye is in the hundred of Hartismere, about 20 miles north of Ipswich. It is on a feeder of the Waveney, now a mere rivulet, but probably navigable at a former though very remote period. Small rudders and other tackle belonging to boats are said by Leland (*Collectanea*, vol. iv., edit. 1770, p. 26) to have been dug up from time to time by the monks of Eye, in clearing out the ditches. The town was incorporated by King John, and sent two members to parliament from the time of Elizabeth to the passing of the Reform Act, when it was reduced to one member. There are some slight remains of the castle, belonging to the Malet family, one of whom founded at Eye a small Benedictine priory, whose yearly revenues at the dissolution were 184*l.* 9*s.* 7½*d.* gross, or 161*l.* 2*s.* 3¼*d.* clear. There are some remains of the monastic buildings, now used as stables, on the east side of the town. The streets of Eye are irregularly laid out and narrow, and the houses are mean. The church is handsome and spacious, with a fine tower of perpendicular character: there are Baptist and Wesleyan meeting-houses. The area of the borough and parish is 2370 acres; the population, in 1831, was 2313. There is little trade, and no manufacture, except a trifling one of lace. The general market is on Saturday, the corn-market on Tuesday, and there are two yearly fairs. The municipal boundaries are coincident with those of the parish of Eye. Before the passing of the Municipal Reform Act, the municipal authorities had no exclusive jurisdiction; no sessions were held, and the court of record had long gone into disuse; under the Municipal Reform Act the borough has 4 aldermen and 12 councillors, but is not to have a commission of the peace except on petition and grant. By the Boundary Act the adjacent the parishes of Hoxne, Denham, Redlingfield, Occold, Thorndon Braisworth, Yaxley, Thrandiston, Broome, and Oakley were, for parliamentary purposes, added to the borough, which thus includes an extensive rural district, about 20,000 acres, with a population, in 1831, of 7015. The number of voters on the register, in 1835-6, was 278; in 1839-40, 332. The living of Eye is a vicarage, of the clear yearly value of 331*l.*, with a glebe-house, in the rural deanery of Hartismere, archdeaconry of Suffolk, and diocese of Norfolk. There were in the borough and parish, in 1833, two dame-schools, with about 60 children; four other day-schools, with 99 children, 47 boys and 52 girls; and three Sunday-schools, with about 280 children of both sexes. One of the day-schools is partly supported by an endowment and a grant from the corporation.

Dunwich is on the coast, in the hundred of Blything, 28 miles from Ipswich, through Woodbridge and Rendlesham. While East Anglia subsisted as a separate kingdom, Dunwich was a place of importance, and the seat of the first East-Anglian bishopric, which may be considered as the predecessor of that which is now fixed at Norwich. It is called in the Saxon Chronicle Domuce or Domuc, and is variously written in other antient authorities Domoc, Dommoc, and Dommoc-ceaster. Various notices in antient authors show it to have been still a place of importance in the time of the Plantagenets, though it appears to have declined under the rising importance of Southwold and Yarmouth. It was the seat of a considerable herring fishery. It was threatened by the insurgents, who in the rebellion of the younger Henry against his father Henry II. overran the county. In the civil war of John, the townsmen adhered to the king, who had befriended the town, and granted it a charter of incorporation. They lost several vessels, and many men, which they had contributed to the king's naval service in the French wars of Edward I. and III. In the war of the roses, they embraced the Yorkist party; and this, by inducing Henry VII. to incorporate the rival town of Southwold, contributed to the decay of the place. But this decay was mainly owing to the encroachment of the sea, which not only ruined the port, but washed away the greater part of the town. Of seven parish churches which it once contained, one only (All Saints) remains, and that is a mere ruin, in the place of which a new church (St. James's) was built a few years since by subscription. Besides All Saints church there are the remains of a Grey Friars' house, and of the chapel of St. James's hospital: they all contain some portions of good architecture, partly Norman. Dunwich is at present a mere village. The market has been discontinued. There is a yearly fair, and some sprats and herrings are caught and cured. The area of the borough and parish (for these are co-extensive) is 3240 acres. The population in 1831 was 232. The corporation has been maintained chiefly for parliamentary purposes, and, as the borough was disfranchised by the Reform Act, will probably go to decay. It has a revenue of about 150*l.* a-year, and is untouched by the Municipal Reform Act. Sessions are held once a year by the borough magistrates, and an Admiralty Court occasionally. The living of Dunwich is a perpetual curacy, of the clear yearly value of 40*l.*, in the rural deanery of Dunwich, in the archdeaconry of Suffolk, and diocese of Norwich. The only school in the parish in 1833 was a Sunday-school, containing from 30 to 40 children, about half of each sex.

Orford is in Plomesgate hundred, 21 miles from Ipswich through Woodbridge. There was a royal castle here in the time of Henry III., who granted a charter to the town, which was previously a borough by prescription. It is now, like Dunwich, a mere village; the market has been given up; and as the borough was disfranchised by the Reform Act, the corporation, which was kept up for parliamentary purposes, will probably become obsolete. It is untouched by the Municipal Reform Act. It has an income of less than 100*l.*, and its jurisdiction is growing into disuse. The area of the borough and chapelry of Orford, including the adjacent hamlet of Gedgrave, is 2740 acres: the population in 1831 was 1302. The village consists of ill-built houses, irregularly laid out, on the north-east bank of the river Alde or Ore, which is navigable. The chapel, when entire, was a large building: the nave alone is now used, and is separated by a wall at the east end of it from the chancel, which is more antient, and has been allowed to fall to ruin. There are some curious portions in the nave. The ruins of the chancel are of Norman architecture: the piers are much varied, and some of them of singular shape. There is a curious font. Only the keep of the castle remains: it is a polygon of eighteen sides, with walls 90 feet high, and has three square towers in its circuit, which overtop the rest of the building. The architecture is Norman. Not far from the town, on the sea-shore near Orford Ness, are two light-houses. The chapelry of Orford is in the parish of Sudbourne, and the benefice is united with the rectory of that parish; they are in the rural deanery of Orford, archdeaconry of Suffolk, and diocese of Norwich: their joint clear yearly value is 577*l.*, with a glebe-house. There were in the borough in 1833 ten day-schools of all sorts (chiefly dame-schools) with 252 children; and two Sunday-schools, with 316 children, viz. 146 boys and 170 girls. There is a lending library for the use of the borough and the parish of Sudbourne. Orford gives the title of earl to the Walpole family.

Clare is in Risbridge hundred, 18 miles south-south-west from Bury. The area of the parish is 3410 acres. The population of the parish in 1831 was 1619, from one-third to one-half agricultural. The town is on the north bank of

the river Stour. The streets are wide, but not paved or lighted, and the houses generally are of mean appearance. The church, which is in the centre of the town, is a fine large building; it has a handsome octagonal font of perpendicular character, and a brass eagle on a pedestal, with the wings expanded, forming the reading-desk. There are places of worship for Baptists and Independents. On the south side of the town are the vestiges of an old castle; the site may be traced, and it appears to have comprehended an area of about twenty acres. The mound on which the keep stood, and some fragments of the walls of the keep, yet remain. Near the ruins of the castle are the remains of a priory of regular canons of St. Augustin; part of the buildings are occupied as a dwelling, and the chapel is converted into a barn. The lordship of Clare gave name to an illustrious family, and the titles of earl of Clare and duke of Clarence were derived from it. There is a weekly market, and there are two small yearly fairs. The living is a vicarage in the rural deanery of Clare, in the archdeaconry of Sudbury, and diocese of Ely, of the clear yearly value of 195*l.*, with a glebe-house. There were in the parish, in 1833, twelve day-schools of all kinds, with 265 children, viz. 116 boys and 149 girls: and three Sunday-schools, with 310 children, viz. 143 boys and 167 girls.

Debenham is in the hundred of Thredling, 13 miles north of Ipswich, on the river Deben, here a mere brook. The area of the parish is 1920 acres. The population in 1831 was 1629, about half agricultural. From its situation on a declivity, the town is clean, but the houses are generally poor. The church is a handsome edifice, and the market-house is a tolerably good building. There is a place of worship for Independents. The market, which is on Friday, is small. There is one yearly fair. The living is a vicarage, in the rural deanery of Cleydon, the archdeaconry of Suffolk, and the diocese of Norwich, of the clear yearly value of 154*l.*, with a glebe-house. There were in the parish, in 1833, three day-schools, with 133 children, viz. 84 boys and 40 girls; and two Sunday-schools, with 279 children, viz. 80 boys, 67 girls, and 132 children of sex not stated. One of the day-schools has an endowment.

Framlingham is in the hundred of Loes, 18 miles north-north-east of Ipswich. It was probably a place of consequence in the Anglo-Saxon period, and St. Edmund, king of the East Angles, is said to have been besieged here by the Danes, A.D. 870. In the middle ages it was important from its strong castle, granted by Henry I. to Hugh Bigod, and at different times held by the Bigods, the Mowbrays, the Howards, and other illustrious families. Sir Robert Hitcham, having purchased the castle and manor of the Howard family, bequeathed them for pious uses to the master and fellows of Pembroke Hall, Cambridge, by which society they are still possessed. The parish of Framlingham has an area of 4470 acres; the population in 1831 was 2445, about two-fifths agricultural. The town stands near the head of the river Ore, which just to the north of the town expands into a spacious pond or mere. The streets are irregularly laid out, but there is a spacious market-place of triangular form, and the houses are many of them well built and respectable. The streets are lighted with oil. The church is in the middle of the town; it is large and handsome, built of black flint, with a tower 96 feet high, in which is a peal of eight bells. The roof of the nave is of curiously carved oak; and in the church are several monuments of the Howards (among them those of Thomas, second duke of Norfolk, and his son the accomplished earl of Surrey, beheaded by Henry VIII.), and the monuments of the duke of Richmond, natural son of Henry VIII., and of Sir Robert Hitcham. On the north side of the town, adjacent to the mere, are the ruins of the castle. The outer wall is yet standing: its form is irregular, approaching to a circle, and it is strengthened at intervals by square towers, thirteen in number. The wall is 44 feet high and 8 feet thick; the towers rise to the height of 58 feet. The principal gateway is on the south side, opposite the town, and is adorned with the arms of the principal families which have possessed the castle, carved in stone. There are some remains of the outworks. The area comprehended by the walls of the castle is above an acre and a quarter; but the demolition of the interior is so complete, that very little idea can be formed of its arrangement. In the vacant area are, or were lately, an almshouse and a workhouse, built of the materials of the castle. The castle was defended, except where it was protected by the mere, by a double ditch, which still remains. There are in the town an almshouse and a free school founded by Sir Robert Hitcham, a second almshouse founded by Thomas Mills, and places of worship for Unitarians, Independents, and Wesleyans. Some malting is carried on in the town. There is a market on Saturday for corn, and occasionally for cattle; and there are two yearly fairs. The living is a rectory, united with the chapelry of Saxtead, which is in the parish, of the clear yearly value of 1201*l.*, in the gift of Pembroke Hall, Cambridge. It is in the rural deanery of Loose (or Loes), in the archdeaconry of Suffolk, and diocese of Norwich. There were, in 1833, twelve day-schools of all kinds, with 294 scholars, namely, 98 boys, 93 girls, and 103 children of sex not stated; and four Sunday-schools, with 378 scholars, namely, 61 boys, 33 girls, and 284 children of sex not stated. Two of the day-schools have endowments, one bequeathed by Sir Robert Hitcham, the other by Thomas Mills.

Hadleigh is in Cosford hundred, 9 miles west of Ipswich. It is said to have been the burial-place of Guthrum the Dane, to whom Alfred ceded East Anglia; and has some interest as the place of martyrdom of Dr. Rowland Taylor, burned in the persecution under Queen Mary, on what is commonly but improperly called Aldham Common, near the town. (Fox's *Acts and Monuments of the Church*, edit. of 1576, pp. 1445-1456.) A stone with this inscription—

'Anno 1555,
Dr. Taylor, for defending what was god,
In this place shed his blod'

marks the spot. The parish of Hadleigh has an area of 3410 acres: the population, in 1831, was 3425, less than one-third agricultural. The town consists of one principal street, running from south-south-east to north-north-west, and other smaller ones branching from it; but none of the streets are paved or lighted. The church is large and handsome, with a tower and spire and two south porches. The aisles and clerestory extend along the chancel as well as the nave. The architecture is chiefly of perpendicular date, but some portions are earlier. The monument shown in this church as the monument of the Anglo-Danish king Guthrum is of later date than the ninth century, in which he died. The rectory-house, adjacent to the churchyard, is antient, and in front of it is a brick gateway with two hexangular towers of the same date (about A.D. 1490) as the house. There are meeting-houses for Independents, Baptists, and Wesleyans; and a range of twelve almshouses with a chapel, built by William Pykeham, rector of this parish, who built the rectory-house and gateway. Some weaving is carried on in the town. There is a good corn and general market on Monday, and there are two yearly fairs: the corn-exchange or market-house is a good modern building. Hadleigh was formerly a corporate town, but the charter was surrendered in the time of James II., and never restored. The living is a rectory, in the peculiar jurisdiction of the archbishop of Canterbury, of the clear yearly value of 929*l*, with a glebe-house. There were in the parish, in 1833, six day-schools, with 132 scholars, viz. 70 boys, 32 girls, and 30 children of sex not stated; four boarding-schools, for which no return was made; two day and Sunday national schools, with 213 children (90 boys and 123 girls) in the week, and 262 children (121 boys and 141 girls) on Sundays; and one Sunday-school, with 210 children, viz. 90 boys and 120 girls. One of the day-schools had three small endowments.

Halesworth is in Blything hundred, 31 miles north-north-east of Ipswich through Woodbridge and Saxmundham. The area of the parish is 1070 acres; the population, in 1831, was 2473, one-fifth agricultural. The town is irregularly laid out: a small stream runs through it, and joins the river Blyth half a mile south-east of the town. The streets are wide, but not paved; and some of the houses are well built. The town is lighted with oil. The church is a handsome Gothic building; and there are places of worship for Baptists and Independents. On the south side of the town is a small theatre. There are some large malthouses, and a considerable trade in malting is carried on. The river Blyth and its branch are made navigable up to the town, and afford facility for the export of agricultural produce, and the import of coal, lime, and general merchandise. There is a corn and general market on Thursday, and there is also a yearly fair. The living is a rectory united with the vicarage of Chediston, in the rural deanery of Dunwich, the archdeaconry of Suffolk, and the diocese of Norfolk, of the joint clear yearly value of 450*l.*, with a glebe-house. There were in the parish, in 1833, an infant-school, with 40 children, chiefly

girls, supported by voluntary contributions; eleven day-schools, with from 267 to 287 children, viz. 117 boys, 120 girls, and from 30 to 50 children of sex not stated; one day and Sunday national school, with 200 children, an equal number of each sex; and one Sunday-school, with 110 children, viz. 50 boys and 60 girls. There were also an evening-school and a lending library.

Lavenham (colloquially shortened into Lanham) is in the hundred of Babergh, 10 miles south-south-east of Bury. The area of the parish is 2800 acres, and it had a population in 1831 of 2107, about one-third agricultural. It is in a healthy situation on the declivity of a hill, at the foot of which flows the little river Bret. It is irregularly laid out, the houses are mean, and the streets are neither paved nor lighted. The market-place is spacious, and there is a stone cross in the centre. There is a bridewell in the town. Lavenham was formerly the seat of a considerable manufacture of blue woollen cloth, and for the regulation of this trade three guilds or companies were established. The wool-hall of the town was much frequented. This manufacture has long passed away, as well as the manufacture of shalloons and serges which succeeded it, and of hempen cloth, a branch of industry of still later date. A little wool-combing and spinning and a little silk-weaving are still carried on. There is a market, almost disused, on Tuesday, and there are two yearly fairs. Formerly the town was governed by six capital burgesses chosen for life; but the authority of these officers, if not the office itself, has come into disuse. The church is large and handsome; it is 156 feet long, 68 feet wide, and has a steeple 141 feet high. The character of the architecture is perpendicular, the clerestory is lofty, and the tower fine, with bold buttresses. The battlements and some other portions are much enriched. The roof is curiously carved; the windows are numerous, and some of them are still embellished with painted glass; and there are one or two remarkable monuments. There are meeting houses for Independents and Wesleyans, and there are several almshouses belonging to the town. The living is a rectory, in the rural deanery and archdeaconry of Sudbury, and the diocese of Ely, of the clear yearly value of 658*l*., with a glebe-house. There were in the parish, in 1833, six day schools, with 125 children, viz. 72 boys and 53 girls; two day and Sunday national schools, with 150 children (75 boys and 75 girls) in the week, and 140 children (70 boys and 70 girls) on Sunday; and two Sunday-schools, with 148 children, namely, 57 boys and 91 girls. One of the day schools is an endowed grammar-school; and two other day schools are partly supported by endowment.

Lowestoffe or Lowestoft, colloquially Laystoff, as it was formerly written by some persons, is in the hundred of Lothingland, 45 miles north east of Ipswich, on the sea. The parish has an area of 1950 acres; the population in 1831 was 4238, scarcely any part of it agricultural. The town stands on the top of a cliff facing the sea, from which it is separated by a beach, in some parts nearly half a mile wide. It consists of one principal well-paved street, nearly a mile long, running north and south, lined with good modern brick houses, and of some smaller streets opening into this on the west side. The houses on the east side of the High-street have gardens at the back sloping down the face of the cliff towards the sea. Buildings have accumulated at the bottom of the cliff on the beach, where the curing-houses for herrings and a rope-walk are situated. The parish church is a large and handsome church of perpendicular architecture, situated nearly half a mile west of the town. The length of the whole building is 182 feet, the breadth 57 feet, the height 43 feet; it has a tower and spire 120 feet high, 50 feet of which belong to the spire. The windows are large and fine, and the east end of the church has some chequer-work of flint and stone. There are in the church an antient font and a number of monuments, including those of Thomas Scroope, bishop of Dromore, who died here, A.D. 1491, of admirals Sir John Ashby and James Mighells, of Potter, the translator of Æschylus and Sophocles, and of several others. There is a chapel-of-ease in the town; and there are places of worship for Baptists, Independents, and Methodists. There are a town-hall or chamber over the market or 'corn-cross,' a theatre, and near the south end of the town a bathing-house. On the cliff is the upper lighthouse, and on the beach are a battery at the south end of the town, and the lower lighthouse. Off the shore are the North and South roads, sheltered to sea-ward by the Corton and Newcome sands. The upper lighthouse is of brick and stone, with a cylindrical revolving lantern furnished with powerful reflectors; the lower lighthouse is of timber. South of the town is the cut communicating between Lake Lothing and the sea, forming part of the line of the Norwich and Lowestoffe navigation. The tide-lock will admit vessels 84 feet long and 21 feet in beam. The principal branch of industry at Lowestoffe is the fishery, which occupies about 200 men. Great quantities of mackerel and soles are caught, and sent to the London and Norwich markets; and a great quantity of herrings are taken and cured. There are rope and twine manufactories. The market is on Wednesday, and there are two yearly fairs. Lowestoffe is also frequented as a bathing-place. The living is a vicarage, in the rural deanery of Lothingland, in the archdeaconry of Suffolk, and the diocese of Norwich, of the clear yearly value of 323*l*., with a glebe-house. There were in the parish, in 1833, an infant-school, with 100 children of both sexes; fourteen day-schools of all kinds (two of them endowed, and one partly supported by subscription), with 125 children, namely, 186 boys, 123 girls, and 116 young children of sex not stated; and two Sunday-schools, with 205 children, namely, 120 boys and 85 girls. There is a lending library in the parish.

Mildenhall is in the hundred of Lackford, 12 or 13 miles north-west of Bury. The parish is extensive, comprehending a considerable district of fenland, and including, beside the town, several detached hamlets, locally termed 'rows,' as Holywell Row, north of the town; Beck Row, north-west; and West Row, west-north-west. The area of the parish is 13,710 acres. The population in 1831 was 3267, about half agricultural. The town stands just on the border of the fen country, which stretches northward into Norfolk, and westward into Cambridgeshire, and is a little to the left of the road from London to Norwich by Newmarket, Barton-Mills, and Thetford. It is irregularly laid out, and the streets are neither paved nor lighted, but the houses are for the most part well-built. The church is large and handsome, with a tower 120 feet high. It has a handsomely carved wooden roof and several monuments. There are meeting-houses for Baptists and for Calvinistic and Wesleyan Methodists. The market, which is on Friday, is well supplied with provisions, especially fish and wild-fowl; and there is a considerable yearly fair. The river Larke, which passes close to the south side of the town, is navigable, and facilitates the export of corn and agricultural produce, in which considerable business is done. The living is a vicarage in the rural deanery of Fordham, in the archdeaconry of Sudbury, in the diocese of Ely, of the clear yearly value of 369*l*. There were in the parish, in 1833, fifteen day-schools, with 330 children, namely, 159 boys and 171 girls; and four Sunday-schools, with 395 children, namely, 196 and 199 girls. One of the day-schools was a national school, with 60 girls, and was partly supported by endowment. The handsome seat of Sir H. E. Bunbury is in the town.

Saxmundham is in the hundred of Plomesgate, 20 miles north-east of Ipswich, on the road to Yarmouth. The area of the parish is 1460 acres; the population in 1831 was 1048, about one-fourth agricultural. The town consists chiefly of one long, narrow, unpaved street, running north and south along the high road, lined with neat, respectable-looking houses. It is in a valley, through which, at the back of the houses, on the east side of the street, runs a small brook, a feeder of the Alde, which it joins about four or five miles south of the town. The church is a neat building just out of the town; and there is a place of worship for Independents. Some business is done in malting and in shipping corn for London from the wharfs on the river Alde. The market is on Thursday, and there are two yearly fairs. The living is a rectory in the rural deanery of Orford, in the archdeaconry of Suffolk, in the diocese of Norwich, of the clear yearly value of 275*l*., with a glebe-house. There were in the parish, in 1833, six day-schools of all sorts, with 132 children, namely, 51 boys and 81 girls; and three Sunday-schools, with 147 children, namely, 80 boys and 67 girls.

Southwold is in the hundred of Blything, on the coast, 36 miles north-east of Ipswich by Woodbridge and Saxmundham. It was in the middle ages a place of some importance, and the townsmen were engaged in frequent disputes with those of Dunwich, occasioned probably by the commercial rivalry of the two places. In the reign of Henry VII. Southwold was incorporated by act of parliament, and the corporate rights of the townsmen were confirmed by bsequent charters of Henry VII. and his successors. In

1659 the town was nearly consumed by a fire, which destroyed the town-hall, the market-house, the prison; besides granaries, shops, warehouses, above two hundred and thirty houses; beside fishhouses, malthouses, brewhouses, and other outbuildings; and a great quantity of corn, merchandise, fishing-nets, and other tackle. The damage was estimated at more than 40,000*l*., and above three hundred families were ruined. It is probable that the town has never reached the prosperity which it enjoyed before this calamity. The area of the borough and parish (which are coincident) is 680 acres: the population, in 1831, was 1875, scarcely any part agricultural. The town is on a hill, forming a cliff toward the sea, and sinking on the other side into the marshes through which the river Blyth, and an arm of it called 'the Buss Creek,' flow. By these waters the hill on which the town stands is almost insulated. The only entrance to the town is on the north-west side, by a bridge over the Buss Creek: and the main street is on the road from this bridge to the face of the cliff: it has flagged footpaths, and is lined near the sea with respectable houses; but in other parts the houses are of inferior character. The top and sides of the hill round the town are unenclosed land, chiefly or wholly common; and there are two windmills and a lime-kiln. The church is near the entrance of the town, on the north-west side, and is a large and handsome building of perpendicular architecture, mostly of flint and stone: it is 143½ feet long, and above 56 feet wide. The western tower is about 100 feet high; and there are two low hexagonal towers at each angle of the eastern end of the chancel. There is a highly ornamented porch, of somewhat later date than the church. The interior of the church has been richly ornamented, but has been much defaced: the painted ceiling of the chancel still remains, and the magistrates' pews are adorned with gilding and painting. There are meeting-houses for Baptists, Methodists, and Independents. The town-hall is a modern building, and there is a small gaol. The principal branch of industry is the fishery, which, in 1831, employed one hundred men: there are some salt-works. Red herrings, red sprats, salt, corn, and malt are exported: and coal is imported. The town is frequented in the bathing season by visitors from the adjacent counties. The quay is on the Blyth, above half a mile south-west of the town.

The Municipal Reform Act assigns to the borough four aldermen and twelve councillors: it is not to have a commission of the peace except on petition and grant. The corporation revenue, derived chiefly from common, marsh, and other lands, is about 800*l*. or 900*l*. a year. The living is a perpetual curacy, in the rural deanery of Dunwich, the archdeaconry of Suffolk, and the diocese of Norwich, of the clear yearly value of 60*l*., with a glebe-house. There were in the parish, in 1833, nine day-schools of all sorts, with from 193 to 213 children, namely, 83 boys, 80 girls, and from 30 to 50 children of sex not stated; and three Sunday-schools, with 316 children, namely, 177 boys and 139 girls. One of the day-schools had an evening class of 10 adults.

Stow-Market is in the hundred of Stow, 12 miles north-west of Ipswich, on the road to Bury, from which it is distant 14 miles east-south-east. The parish has an area of 1240 acres: the population, in 1831, was 2672, about one-sixth agricultural. The town consists of one main street along the Bury and Ipswich road, and of some smaller ones; the streets are for the most part paved, and lined with tolerably good houses; indeed several of the houses are very good, and the town is lighted with gas. The church is spacious and handsome, built of flint and stone: the architecture is partly decorated, partly perpendicular. The tower, which contains a peal of eight bells, is surmounted with a light and elegant wooden spire, the whole being 120 feet high. There are places of worship for Baptists and Independents. There is a small manufacture of rope, twine, and sacking; an iron-foundry; and a great number of malt-houses. Near the town are hop-plantations, brick-yards, and a water-mill. The Gipping has been made navigable up to the town, and a considerable quantity of corn and malt are sent in river-craft down to Ipswich to be shipped there: timber and deals, coals and slate, are brought up from Ipswich for the supply of the neighbourhood. The bank of the river forms an agreeable walk. There is a well-supplied corn, cattle, and general market on Thursday; and there are three yearly fairs. The living is a vicarage united with the adjacent vicarage of Stow-Upland, in the rural deanery of Stow, the archdeaconry of Suffolk, and the diocese of Norwich: their joint clear yearly value is 281*l*., with a glebe-house. There were in the parish, in 1833, seventeen day-schools, with 199 boys and 188 girls, together 387 children; one day and Sunday national school, with 64 boys and 42 girls, together 106 children; and two Sunday-schools, with 141 boys and 139 girls, together 280 children.

Woodbridge is in the hundred of Loes, on the river Deben, 7 miles east-north-east of Ipswich on the road to Yarmouth. The area of the parish is 1650 acres; the population, in 1831, was 4769, scarcely any part of it agricultural. The town stands on the north-west bank of the river, which, at high-water, is a quarter of a mile wide: it consists of two principal streets (one of them near a mile long), which contain many good houses and are well paved; and of several smaller streets and lanes. The market-place is spacious, and surrounded with well-built houses: in the centre of it is an antient shire or sessions hall, in which quarter-sessions for the division are held: the lower part of the hall is the corn-market. The church is large and handsome, built chiefly of black flint: it has a large square tower, built of flint and stone, 180 feet high: toward the top the flint and stone are so intermingled as to form various devices. In the church are several monuments. There are places of worship for Quakers, Independents, Baptists, and Methodists. There are a custom-house, a small theatre and barracks, and near the town is a bridewell. Woodbridge is a place of considerable trade: it is a port, and the river Deben is navigable for small coasting vessels: the tide flows above the town. Corn, malt, and flour are exported; and coal, timber, and general merchandise imported. There are two good quays on the bank, and formerly small vessels were built in the Limekiln Docks. The market is on Wednesday for corn, cattle, and provisions; and there are two yearly fairs. The living is a perpetual curacy, in the rural deanery of Carlesford, in the archdeaconry of Suffolk, and diocese of Norwich, of the clear yearly value of 500*l*. There were in the parish, in 1833, six dame-schools, with 44 boys and 56 girls, together 100 children; seventeen other day-schools, with 360 boys and 311 girls, together 671 children; one day and Sunday national school, with 218 boys and 104 girls, together 322 children; and four Sunday-schools, with 157 boys and 256 girls, together 413 children. There are a range of almshouses in the town, for the support of which, and for other charitable purposes, Thomas Seckford, master of requests in the reign of Queen Elizabeth, left an estate in Clerkenwell, one of the suburbs of London, the increased value of which estate has rendered the charity very wealthy. Woodbridge had before the Reformation a small priory for canons of St. Augustin adjacent to the church. The yearly revenue at the dissolution was 50*l*. 3*s*. 5½*d*.

Bildeston, or Bilston, is in Cosford hundred, on a small stream which flows into the Bret, about 14 miles west-north-west from Ipswich. It had formerly a considerable manufacture of blue cloth and blankets; but this branch of trade has long been given up. Some yarn is spun. The market, which was on Wednesday, is disused; but there are two yearly fairs. The area of the parish is 1420 acres: the population, in 1831, was 836, about one-third agricultural. The church is a good building, on a hill west of the village; and there is a Baptist meeting-house.

Blythburgh is in Blything hundred, on the south bank of the Blyth, 30 miles north-east of Ipswich. The area of the parish is 3590 acres: the population in 1831 was 579, almost entirely agricultural. It is a place of great antiquity; and Anna, king of the East Angles, who fell in battle against Penda of Mercia, in the time of the Heptarchy, is said to have been buried here. It was in the middle ages an important fishing and trading town. Sessions for the division were held here, and there was a gaol, of which some portions remained to the middle of the last century. The church has been a very fine building, highly ornamented both within and without: the architecture is of perpendicular character; but the tracery and other parts have been much defaced. The length of it is 127 feet, the width above 54 feet. There are some remains of painted glass in the windows, and there are some monuments, one of which is pointed out, but erroneously, as that of Anna, the East Anglian king, and another as that of his son, who fell in the same battle. There are some remains of a priory for the canons of St. Augustin; this priory was a dependency of the abbey of St. Osyth in Essex; its yearly revenues at the dissolution were 48*l*. 8*s*. 10*d*. There are some remains of another religious house. The suppression of the religious

houses, and a great fire in 1676, are supposed to have led to the decay of the town.

Botesdale is in the hundred of Hartismere, 15 miles north-east from Bury, on the road to Norwich by Scole. With the village of Rickingall Inferior, which is in Blackburn hundred, it forms a street of more than a mile long, lined with indifferently built houses. The area of the two parishes is 2050 acres; their joint population in 1831, 1120, nearly half agricultural. The market, formerly held at Botesdale on Thursday, has been discontinued, but there is a yearly fair. The chapel at Botesdale (the parish is only a parochial chapelry) has some good portions of perpendicular architecture. It is dedicated to St. Botolph; and the name of the village is a corruption of St. Botolph's dale. Near the church is the grammar-school, which had, in 1833, above 30 scholars. Near Botesdale is Redgrave Hall, the handsome seat of Admiral Wilson; and in Redgrave church, which is about 2 miles from Botesdale, is a handsome monument to chief-justice Sir John Holt.

Brandon is in the hundred of Lackford, about 17 miles north-north-west of Bury, through Thetford. The area of the parish is 5570 acres; the population in 1831 was 2065, barely one-tenth agricultural. The village consists of three streets along the Mildenhall, Elvedon, and Thetford roads, which converge and form one main street leading by a neat stone bridge over the Little Ouse into Norfolk. The houses are for the most part well built. The church is a little out of the village on the south-west, and is a good structure. The market has been discontinued for many years; but there are three yearly fairs. There are extensive rabbit-warrens in the neighbourhood, of which one alone is said to have furnished to the London market 40,000 rabbits yearly. Continuous strata of the finest flint occur in the chalk near the town, and are dug and manufactured into gun flints, a branch of industry that in 1831 gave employment to 60 men. Considerable trade is carried on in corn, malt, coal, timber, and other goods, favoured by the navigation of the little Ouse or Brandon river, which passes on the north side of the village. The duke of Hamilton and Brandon takes his latter title from this village. There is an endowed free school.

Haverhill is in Risbridge hundred, about 16 miles south-east of Bury: both village and parish extend into the adjacent hundred of Hinckford, in the county of Essex. The area of the parish is 3320 acres; the population in 1831 was 2025, probably a fourth agricultural. The village consists of one principal street, wide, but lined with poor houses, running from south-east to north-west along the road from Colchester to Cambridge. The church is a large antient building, and there are two dissenting places of worship. There was antiently another church, and half a mile north-west of the town was a castle, of which there are no remains. The market has been for some years discontinued, but there are two yearly fairs. In the year 1831, 173 men were employed in the manufacture of drabbets and Tuscan plat.

Ixworth is in Blackbourn hundred, 7 miles north-east of Bury. The area of the parish is 2320 acres; the population in 1831 was 1061, more than half agricultural. There was antiently a priory for the regular canons of St. Augustin, founded about A.D. 1100; the yearly revenues of which at the dissolution were 280*l*. 9*s*. 5*d*. (or, according to some authorities, 204*l*. 9*s*. 5½*d*.) gross, or 168*l*. 19*s*. 7¾*d*. clear. The village consists of one main street along the road from Bury to Norwich by Scole, and of one or two smaller streets. There are some remains of the priory, near which is the parish church, as mall but antient building. Some Roman remains have been discovered near the village. The market was given up some years since.

Mendlesham is in Hartismere hundred, about 15 miles north-north-west of Ipswich. The parish has an area of 4420 acres: the population in 1831 was 1233, more than two-thirds agricultural. The village consists of mean houses, and the market has long been given up. The church is a handsome building, and there is a Methodist meeting-house. An antient silver crown of sixty ounces weight was found here near the close of the seventeenth century: it was supposed to have belonged to one of the East Anglian kings.

Needham-Market is in Bosmere and Claydon hundred, 8 miles north-west of Ipswich, on the road to Bury. The area of the parish of Barking, in which the place stands, is 3010 acres: the population in 1831 was 1884, of which 1466 persons belonged to the hamlet or chapelry of Needham-Market. The village consists of one principal street and of some smaller ones: the houses are neat, and some of them even handsome. The chapel is a mean building, with a wooden belfry; and there are one or two dissenting places of worship. The woollen manufacture, formerly carried on here, has been long extinct; and of late years the market has been given up: a little paper and glue are made. The Gipping, which passes the town, is navigable. There is an endowed grammar-school.

Neyland or Nayland is in the hundred of Babergh, 13 or 14 miles west-south-west of Ipswich. The area of the parish is 1470 acres: the population in 1831 was 1047, about one-third agricultural. The village is in a low situation, on the north bank of the river Stour, over which there is a brick bridge, and is occasionally subject to inundation. There are some good dwelling-houses in the place, and some large flour-mills: a considerable quantity of corn and flour is sent down the Stour to be conveyed to London. There is a yearly fair. The church is a handsome building, and there is a meeting-house for Independents. There is a national school. The market has been given up for some years, and the woollen manufacture, once flourishing, is quite extinct.

Woolpit is in the hundred of Thedwestry, 8 miles east by south of Bury, on the road to Stow-Market and Ipswich. The area of the parish is 2010 acres; the population in 1831 was 880, less than half agricultural. The church is built partly of flint and chalk; it is a handsome building, partly of decorated, partly of perpendicular character. There is a large south porch, much enriched, but the spire is mean. The market has long been given up; but there is a yearly cattle fair, one of the largest in the county, if not in England. A very white brick, of remarkably neat and beautiful appearance, is made near the village.

The following villages may just be noticed. Long Melford is in Babergh hundred, about 2 miles north of Sudbury. It consists of one street, nearly a mile in length, extending along the road from Sudbury to Bury. The church is large, and of perpendicular character, with an extensive building, [in chequer-work, of flint and stone at the east end. Melford has some old mansion-houses and an alms-house or hospital The population in 1831 was 2514, about one-third agricultural. Yoxford, in Blything hundred, is on the Yarmouth road, about 4 miles beyond Saxmundham. It is pleasantly situated and has a well-built street of modern houses. The population in 1831 was 1149. Hoxne (antiently Eglesdune or Hagilsdun) has some historical interest as the place where St. Edmund was taken and killed by the Danes. It is in the hundred of Hoxne, on the bank of the Waveney, not far from Eye. The population in 1831 was 1243. Fressingfield, in the same hundred, was the birthplace of Archbishop Sancroft, and the place to which he retired after his deprivation The population in 1831 was 1352. Stradbrook (population in 1831, 1527), in the same hundred, was the birthplace of Robert Grosseteste, bishop of Lincoln. East Bergholt and Stratford St. Mary are both in Samford hundred, near the bank of the Stour, between Colchester and Ipswich. East Bergholt has, from the number of good houses in it, an appearance superior to that of most villages. The church is of perpendicular architecture, and has some curious portions. Stratford is pleasantly situated, and has a handsome church. At Freston, on the bank of the Orwell, in the same hundred, is a quadrangular stone tower, about ten feet by twelve in area, and six stories high, with a polygonal turret at each angle. Its date and purpose are not ascertained. The population of East Bergholt in 1831 was 1360, of Stratford 630, and of Freston 183. Wickham-Market (population in 1831, 1202), in Wilford hundred, between Woodbridge and Saxmundham, is on a hill commanding an extensive prospect. South-Town and Gorleston, in Lothingland hundred, are suburbs of Yarmouth, and are included in its parliamentary boundaries. [YARMOUTH.]

Divisions for Ecclesiastical and Legal Purposes.—Suffolk is partly in the diocese of Norwich: it was formerly wholly included in it; but by the late alterations in the territorial arrangements of the church, the greater part of the archdeaconry of Sudbury, and part of the archdeaconry of Suffolk, have been transferred to the diocese of Ely. The eastern part is in the former diocese, the western part in the latter. The present ecclesiastical division of the county is as follows:—

1. Diocese of Norwich.

Archdeaconry of Suffolk.

Rural Deaneries.	Rect.	Vic.	Perp. Cur.	Chapelries, &c.	Total Cures.
Bosmere	19	4	4	3	30
Carlesford	9	2	6	.	17
Claydon	7	5	.	.	12
Colneys	9	3	.	2	14
Dunwich	20	13	15	1	49
Hartismere (formerly belonging to the archdeaconry of Sudbury)	27	4	2	2	35
Hoxne	11	9	3	3	26
Ipswich	5	.	7	1	13
Loose	11	4	3	1	19
Lothingland . . .	18	6	2	1	27
Orford	10	6	5	.	21
Samford	19	6	2	.	27
Southelmham . . .	6	2	.	.	8
Stow (formerly belonging to the archdeaconry of Sudbury) .	6	5	1	1	13
Waynford, or Wangford .	13	5	3	.	21
Wilford	8	6	2	.	16
	198	80	55	15	348

2. Diocese of Ely.

Archdeaconry of Sudbury.

Rural Deaneries.	Rect	Vic.	Perp. Cur	Chapelries, &c.	Total Cures.
Blackburne (formerly included in the archdeaconry of Suffolk)	27	.	7	2	36
Clare	17	.	7	5	29
Fordham*	11	5	.	2	18
Sudbury	35	9	5	2	51
Thedwaster . . .	18	4	.	.	22
Thingo	18	.	.	.	18
	126	18	19	11	174
Total of the county .	324	98	74	26	522

By the union of cures the number of benefices is considerably reduced. Peculiars are not enumerated above. Chapels-of-ease are included in the fourth column. The above enumeration is from Cox's 'Clergy List' for 1842.

The peculiars are, Hadleigh and Monks-Eleigh rectories, and Moulton rectory and vicarage, belonging to Canterbury, and Freckenham rectory and vicarage, belonging to Rochester.

The county is included in the Norfolk circuit. The assizes are held in the spring at Bury St. Edmunds, and in the summer at Ipswich. The judges proceed to these places from Cambridge. Quarter-sessions for their respective divisions are held at Bury, Ipswich, Beccles, and Woodbridge. There are county gaols and houses of correction at Bury and Ipswich: county houses of correction at Woodbridge and Beccles; and borough prisons at Ipswich, Bury, Eye, Sudbury, Aldeburgh, Southwold, and Orford. The county gaol and house of correction at Ipswich was built A.D. 1790, on what was then considered the best plan; but there are several defects in the arrangement, and some additions which have been made are ill adapted to the original plan. The county gaol and house of correction at Bury are in an airy situation, just out of the town, well drained and well ventilated. The house of correction for females is a short distance from the gaol. The general management both of the county gaol and house of correction, and of the house of correction for females, is satisfactory. The houses of correction at Woodbridge and Beccles are ill arranged, and inadequate to that purpose. Of the borough prisons, some are inadequate and inconvenient: those at Orford and Aldeburgh are seldom used; and for the borough of Bury, prisoners are commonly sent to the county prison.

Suffolk is divided into the 'Geldable' portion, in which issues and forfeitures are paid to the king, and the 'Franchises,' in which they go to the lords of the liberties. The Geldable part comprehends the hundreds of Blything, Bosmere and Claydon, Hartismere, Hoxne, Lothingland and Mutford (two half hundreds), Samford, Stow and Wangford. The sessions held at Ipswich and Beccles are for this portion. The franchises or liberties are those of—1. St. Ethelred, including the hundreds of Carlford, Colneis, Loes, Plomesgate, Thredling, and Wilford; 2. St. Edmund, including the hundreds of Babergh, Blackbourn, Cosford, Lackford (including the half-hundred of Exning or Ixning, which is the part of the county nearly surrounded by Cambridgeshire), Risbridge, Thedwestry, and Thingoe; and 3. the Duke of Norfolk, including certain of his manors, for which he returns all writs, and receives all fines and amercements: he has also the right of appointing a coroner. The sessions for the two liberties of St. Ethelred and St. Edmund are held at Woodbridge and Bury respectively. The liberty of St. Edmund returns a grand jury at the assizes distinct from that returned by the rest of the county.

The counties of Norfolk and Suffolk were under one sheriff until the year 1576.

Before the Reform Act Suffolk returned sixteen members to Parliament: two for the county; and two each for the boroughs of Ipswich, Bury, Sudbury, Eye, Orford, Aldeburgh, and Dunwich. Ipswich and Sudbury were open boroughs, but very corrupt; Eye had about 200 voters; none of the others had more than 40 voters. By the Reform Act, the county was formed into two divisions, the Eastern and Western, each returning two members; Dunwich, Orford, and Aldeburgh were entirely disfranchised, and Eye was reduced to one member. Eleven members are therefore now returned from Suffolk, being five less than before the Reform Act.

The Eastern division of the county comprehends the hundreds of Blything, Bosmere and Claydon, Carlford, Colneis, Hoxne, Loes, Lothingland, Mutford, Plomesgate, Samford, Thredling, Wangford, and Wilford. The court of election is held at Ipswich; and the polling-places are Ipswich, Woodbridge, Needham-market, Framlingham, Saxmundham, Beccles, and Halesworth. The Western division comprehends the hundreds of Babergh, Blackbourn, Cosford, Hartismere, Lackford, Risbridge, Stow, Thedwestry, and Thingoe. The court of election is held at Bury; and the polling-stations are Bury, Wickham Brook, Lavenham, Stow-market, Botesdale, Mildenhall, and Hadleigh. A slight addition was made to Sudbury, and a considerable one to Eye.

The constituency is as follows:—

	[illegible]ders on the Register 1835 6.	18[illegible] 0.
East Suffolk . . .	6147	6104
West Suffolk. . . .	1952	5091
Ipswich	1418	1619
Bury	654	704
Sudbury	578	594
Eye	278	332

History and Antiquities.—Suffolk appears to have been comprehended with Norfolk in the territories of the Simeni (Σιμενοι) of Ptolemy, called by others the Iceni; or, if we follow Richard of Cirencester, it was in the territory of the Cenomanni, one of the divisions of the great Icenian nation. It was included in the Roman province of Flavia Cæsariensis. There were several British or Roman towns in this county, as the Sitomagus, Cambretonium, and Ad Ansam of Antoninus, and probably the Villa Faustini and Iciani of the same writer; and the Garannonum of the Notitia Imperii. The river Waveney and its valley appear, in the British and Roman periods, to have been one of the branches of that great æstuary which penetrated so deeply inland on this side of the island, as described elsewhere. [Norfolk, vol. xvi., p. 259.] It is there noticed that the æstuary penetrated at least as far as Bungay: it probably extended higher up, for we have seen that traces of antient navigation have been noticed as far up as Eye, which must have stood either upon a branch of this æstuary, or on some navigable river running into it.

The exact locality of the above-mentioned towns has been the subject of much difference of opinion. It will be well first to notice the direction in which Roman or other antient roads have been traced. A road from Londinium (London) and Camulodunum (Colchester) entered the county at Stratford, between Colchester and Ipswich, and leaving Ipswich on the right, ran in a northward direction to the Ipswich and Norwich road near Needham-market, and then coincided with the present line of that road till it quits the county to enter Norfolk at Scole inn.

Another line, 'the Peddar-way,' or 'Ieddar-way,' entering the county from Norfolk, across the Little Ouse near Rushford, runs southward to the neighbourhood of Ixworth, where Roman remains have been discovered. We believe this road has not been traced beyond Ixworth, or indeed scarcely so far; but the direction of existing lanes and roads, and the names of places, lead us to conjecture that it ran by Norton-Street, Woolpit, Fen-Street, and Low-Street to the neighbourhood of Bildeston, and possibly joined the road already described at the passage of the Stour at Stratford. 'The Ickneld-way,' or 'Icknield-Street,' crossed the county in a south-west direction from the Little Ouse to the neighbourhood of Newmarket. Another line, nearly parallel to this, appears to have run from the source of the Waveney and

* The rural deanery of Fordham is partly in Cambridgeshire, but the statement given above includes only that part which is in Suffolk.

Little Ouse (perhaps then the narrowest part of the æstuary, which, according to some traditions, insulated Norfolk) by Ixworth to the neighbourhood of Bury. Both these roads must have crossed the line of the Peddar-way, the latter near Ixworth, the former a few miles north of it. Besides these, there was in the eastern part of the county a road which entered the county across the æstuary of the Waveney at Bungay, and ran by Halesworth to Dunwich: it is known as Stone-Street; and a road crossed the south-western corner of the county by Haverhill, part of a line from Camalodunum (Colchester) to Camboritum (Cambridge). These are, we believe, all the known roads; but the remarkable peculiarities in the direction of existing roads and lanes convince us that a Roman road entered the county across the æstuary, now the valley of the Waveney, near Harleston in Norfolk, and ran to Peasenhall, in a direction which if continued would meet the coast at Aldeburgh. We think it probable too that a line of road branching from this at Peasenhall, or perhaps crossing it, in which case it may have come from near Southwold and Blythburgh, or else from Dunwich, ran into the line of road first described by Stone-Street, in the neighbourhood of Needham-Market.

Ad Ansam may be fixed at Stratford. The distance from Colchester (Camalodunum) coincides with that given by Antoninus, and the name Strat-ford, indicative of its position on the line of a Roman road or 'street,' convinces us that this position is correctly fixed. The distance given by Antoninus of the positions between Ad Ansam and Venta Icenorum (Caister, near Norwich) prevent our following the direct line of road; and the stations Cambretonium and Sitomagus, which occur in the interval, must be considered as doubtful. The proposal to fix them respectively at Grundisburgh, or rather Burgh, near Ipswich, where there is an antient encampment, and at Dunwich, is perhaps the best supported by a general though not exact accordance with the Antonine distances, and with the recognised pre-eminence of Dunwich in early Saxon times. It may be added that king Alfred calls Dunwich 'Dommoc-ceaster,' furnishing thus another indication of its Roman origin. The proposal to fix Sitomagus at Stowmarket, or Woolpit, we hold to be inadmissible. Blythburgh, though it has a better claim than either of these places, is not, we think, so well suited as Dunwich. Camden's opinion that Cambretonium was at Brettenham, is not objectionable in itself, but it renders it difficult to fix the position of Sitomagus. As for Iciani and Villa Faustini, we can only conjecture that the first was at Ixworth, where are some Roman remains, and the second on the Roman road at Yaxley, near Eye. Burgh castle, one of the most remarkable Roman remains in England, is described elsewhere. [BURGH CASTLE, vol. vi., p. 26.] It is generally supposed to have been the Gariannonum of the Notitia, but this may be doubted. [NORFOLK, vol. xvi., p. 268.]

Roman antiquities have been found at Blythburgh, on Bungay common, at Bury, at Dunwich, at Eye, at Haughley, near Stowmarket, where a Norman castle was erected on the site of a Roman camp, at Icklingham, near Mildenhall, at Ickworth, near Bury, at Ixning or Exning, near Newmarket, at Ixworth, at Pakenham near Ixworth, where a tessellated pavement was dug up, at Stow Langtoft in the same neighbourhood, where are the remains of a camp, at Felixtow near the mouth of the Deben, and at Wenham near Stratford.

In the Anglo-Saxon period Suffolk passed through similar changes to Norfolk. [NORFOLK.] It was probably settled by a body of Angles independent of those who occupied Norfolk. The names of South Folk and North Folk describe the relative position of these two bodies. Suffolk was probably, from its proximity to the other Anglo-Saxon states, the more important division of the two, and the scene of several events. The battle in which Annas or Anna, king of East Anglia, and his son Firminius, fell fighting against Penda, king of Mercia (A.D. 654), is supposed to have occurred at Bull camp or Bulchamp, near Blythburgh. Annas is said to have been buried at Blythburgh. St. Edmund, king of East Anglia, contemporary of Ethelred I., brother and predecessor of Alfred the Great, was taken by the Danes (A.D. 870), and cruelly murdered at Hagilsdun, now Hoxne (on the bank of the Waveney, near Scole), and was first buried there; but his body was afterwards removed to Bury, which has obtained from him its distinctive title of Bury St. Edmunds. In the Danish wars in the reign of Ethelred II., Ipswich was twice plundered by the Danes, once in A.D. 991, and again two years afterwards, A.D. 993. Again, in A.D. 1010, they occupied the town, extended their ravages inland, and gained a victory over the East Anglians, who, under their general Ulfcytel or Ulfkyttle, made head against them. The scene of this battle is not stated. In the closing period of the Anglo-Saxon dynasty, Suffolk was a separate earldom, under Gurth, the brother of Harold II. Gurth, as well as Harold, fell at Hastings.

In the civil war of Stephen and Henry of Anjou, afterwards Henry II., Ipswich, which was held by Hugh Bigod for Henry, was taken by Stephen (A.D. 1153). In the war of Henry the younger and his brothers against their father, Henry II., a body of Flemings under the Earl of Leicester, a partisan of the young prince, landed in Suffolk, at Walton, south-east of Ipswich, and were joined by Hugh Bigod, one of the most powerful noblemen of these parts. After vainly besieging Walton Castle, they advanced inland, and at Fornham St. Genoveve, on the bank of the Lark, between Bury and Mildenhall, were met and routed, with the loss of above ten thousand Flemings, by the king's army under Richard de Lacy and Humphrey de Bohun, constable of England. The Earl of Leicester and his wife were taken prisoners (A.D. 1173). Bigod, who had still a considerable force, made his peace with the government. In the civil war of John, the county was reduced to subjection (A.D. 1216) by William Fitzpiers, Robert Fitzwalter, and William de Huntingfield, dispatched for the purpose by Prince Louis of France, whom the barons had invited over to oppose John. In the insurrection of the populace in the time of Richard II. (A.D. 1382), those of Suffolk took arms, and murdered, at Bury, Sir John Cavendish, chief justice of England, and some of the monks of the abbey. The Essex insurgents appear to have been driven into this county after their first defeat at Billericay, and suffered a second defeat at Sudbury. In the rebellion of Lambert Simnel, Henry VII. raised an army, which he placed under the command of the Earl of Oxford to oppose a descent which he was apprehensive might be made in this county by a force from Flanders. In the disturbances caused by the attempt of Henry VIII. and his minister Wolsey to raise money by a royal decree (A.D. 1525), the people of Suffolk rose in rebellion, but the dukes of Norfolk and Suffolk prevailed on them to disperse. A part of the inhabitants of Suffolk took part in Kett's rebellion (A.D. 1549). On the death of Edward VI. and the proclamation of Lady Jane Gray as his successor, the Princess Mary, Edward's sister, who was at Kenninghall in Norfolk, removed to Framlingham Castle, where her partisans flocked to her. The Duke of Northumberland, Jane's father-in-law and general, advanced to Newmarket and from thence to Bury to oppose Mary, but retired next day to Cambridge; and the general feeling of the kingdom being in favour of Mary, she advanced from Framlingham to London, dismissing her Suffolk forces by the way.

In the middle ages Suffolk appears to have abounded with religious establishments. Tanner (*Notitia Monastica*) enumerates fifty abbeys, priories, hospitals, or colleges. Only three however of the greater monasteries, viz. those with 200*l.* clear yearly revenue, were in the county, viz. the abbeys of St. Edmunds Bury, Sibton, and Butley. The yearly revenue of Bury abbey (Benedictine) at the dissolution was 2336*l.* 16*s* gross, or 1659*l.* 13*s.* 11½*d.* clear; that of Butley Abbey (for canons of St. Augustin) was 318*l.* 17*s.* 2¼*d.*; and that of Sibton Abbey (Cistercian) was 250*l.* 15*s.* 7½*d.* The interesting remains of Bury Abbey are noticed elsewhere and the monastic ruins of Bungay. [BURY; BUNGAY.] Of Butley Abbey, between Woodbridge and Orford, the gate-house is the principal remain; it is incorporated in a modern mansion: there are some other remains of the abbey, but of less moment. Of Sibton Abbey, which is near Yoxford, on the road from Ipswich to Yarmouth, there are extensive remains. The monastic ruins of Eye, Dunwich, and Clare have been noticed in the former part of this article. There are some remains of Herringfleet Priory for canons of St. Augustin near Lowestoffe; of Leiston Premonstratensian abbey, near the coast, between Dunwich and Aldeburgh; and of Mendham Cluniac priory, on the Waveney, the latter partly converted into a farm-house. Of castellated remains the most remarkable are Framlingham, Orford, and Clare, already noticed; Bungay, noticed elsewhere [BUNGAY]; and Mettingham and Wingfield. Mettingham Castle is near Bungay; a considerable portion

of the gate-tower and fragments of the walls are standing. Wingfield is near Eye, the south or entrance front is still entire; the west side has been made into a farm-house. Of old mansion-houses, with which the county abounds, Flixton hall near Bungay; Giffard's hall, at Stoke by Neyland, on the Stour; Helmingham hall, near Debenham; Hengrave hall, north west of Bury; Kentwell hall and Melford hall, near Sudbury; and Parham hall near Framlingham, may be mentioned.

Few events connected with the great civil war of Charles I. occurred in this county. In the Dutch war of Charles II. two fierce engagements were fought on the coast. The first was fought 3rd June, 1665, off Lowestoffe. The English fleet consisted of one hundred and fourteen ships of war and a number of fireships and ketches, under the duke of York (afterwards James II.), having under him Prince Rupert, the earl of Sandwich, Penn, Lawson, Ayscue (or Ayscough), and other admirals; and the Dutch fleet, of above one hundred ships of war, besides small vessels, under admirals Opdam, Evertzen, Cortenaer, Cornelius van Tromp, and others. After a severe battle the Dutch were beaten with the loss of eighteen men of war taken and fourteen sunk or burned. The English lost one ship. The second battle was fought in Southwold Bay or Sole Bay, in 1672. A combined fleet, consisting, according to the lowest statement, of sixty-five English and thirty-five French men-of-war, under the duke of York as commander-in-chief, having under him the earl of Sandwich, Sir Joseph Jordan, Count d'Etrees, the French admiral, and others, was lying in the bay in careless security, in spite of the warning of Lord Sandwich, who had pointed out the danger of their being surprised, when a Dutch fleet of seventy-five, or, according to some accounts, of ninety-one men-of-war and a great number of smaller vessels, under De Ruyter, as commander-in-chief, with Evertzen, Van Ghent, Bankert, and others, came unexpectedly on them, on the 28th of May. A severe but indecisive action ensued. The English lost six ships of war, two burned, three sunk, and one taken. The earl of Sandwich was killed, and a number of officers and 2000 men killed and wounded. The French are charged with having hung back in consequence of secret instructions from their own government; however they lost two ships, and their rear-admiral was killed. The Dutch lost only three ships of war, but a great number of smaller vessels; their loss of men was probably great, as the States-General forbade the publication of it.

(*Ordnance Survey of England*; Conybeare and Phillips's *Outlines of the Geology of England and Wales*; Rickman's *Gothic Architecture*; *Beauties of England and Wales*; Gardner's *History of Dunwich*; Southey's *Naval History*, in Lardner's *Cabinet Cyclopædia*; Carte's *History of England*; *Parliamentary Papers*.)

Statistics.

Population and Occupations.—In 1831 Suffolk ranked the ninth among the agricultural counties, and 31,491 families out of 61,533 were 'chiefly employed in agriculture.' In manufacturing and non-agricultural occupations it stood the thirty-sixth in the list of English counties. In the manufacture of mixed silk and worsted stuffs 269 men were employed at Sudbury; 173 men were employed in drabbets and Tuscan plait at Haverhill, and 11 at Heddington; 42 in silk at Glimsford; a few at Lavenham; and 13 weavers at Hadleigh. At Brandon 60 men were employed in making gun-flints. At the same period, of males aged 20 and upwards, there were 4256 occupiers of land employing labourers; 1121 occupiers not employing labourers, and 33,040 were agricultural labourers, the latter being 46 per cent. of the total male population of the above age. The remainder of the male population aged 20 and upwards was thus distributed:—employed in manufactures, 676; in retail trades and handicrafts, 18,167; capitalists, bankers, and members of the professions, 2228; non-agricultural labourers, 5336; domestic servants, 1342; other males aged 20 and upwards, 4940. The number of male servants under 20 was 690; and there were 11,483 female servants.

The population of the county at the following periods was as under:—

	Males.	Females.	Total.	Increase per Cent
1801	101,091	109,340	210,431	
1811	111,988	122,223	234,211	11·3
1821	132,410	138,132	270,542	15·5
1831	145,769	150,548	296,317	9·5
1841	154,107	161,022	315,129	6·3

The population increased 104,698 from 1801 to 1841, being 49 per cent.; the increase for England during the same period being 79·9 per cent. The details of the census of 1841 are not yet fully published, but the number of inhabited houses was 64,081; uninhabited 2317; and 577 were building.

The population, &c. of each hundred and borough, according to the census of 1831, was as follows:—

Hundreds, Boroughs, &c.	Houses.				Occupations.			Persons.			
	Inhabited.	Families.	Building.	Uninhabited.	Families chiefly employed in agriculture.	Families chiefly employed in trade, manufactures, and handicraft.	All other Families not comprised in the two preceding classes.	Males.	Females.	Total of persons.	Males twenty years of age.
Babergh	4,489	5,179	15	103	2,996	1390	793	11,872	11,806	23,678	5,609
Blackbourn	1,929	2,855	4	32	1,979	590	286	7,246	7,021	14,267	3,553
Blything	3,917	4,998	13	88	2,799	1,251	948	11,950	12,227	24,177	5,967
Bosmere and Claydon	2,361	2,591	6	21	1,808	555	228	6,478	6,478	12,956	3,193
Carlford	1,014	1,325	5	13	915	244	136	3,227	3,121	6,348	1,576
Colneis	647	883	2	9	592	188	103	2,173	2,196	4,369	1,085
Cosford	1,917	2,157	2	51	1,146	600	411	5,229	5,260	10,489	2,564
Hartismere	2,412	3,559	19	25	2,212	940	407	8,726	9,145	17.871	4,171
Hoxne	2,162	3,282	5	34	2,227	734	321	8,261	8,138	16,399	4,033
Lackford	2,401	2,713	20	53	1,123	821	769	6,539	6,570	13,109	3,133
Loes	2,502	2,768	31	48	1,148	867	753	6,550	6,994	13,544	3,121
Mitford and Lothingland	2,965	3,302	22	101	1,180	870	1,252	7,425	7,830	15,255	3,746
Plomesgate	1,730	2,383	6	26	1,230	639	514	5,506	5,779	11,285	2,722
Risbridge	2,850	3,349	17	58	2,187	870	292	8,070	8,145	16,215	3,980
Samford	1,652	2,187	7	24	1,494	416	277	5,679	5,563	11,242	2,888
Stow	1,390	1,716	19	25	907	498	311	4,133	4,175	8,308	2,039
Thedwestry	1,523	2,139	11	29	1,561	365	213	5,068	5,035	10,103	2,488
Thingoe	963	1,224	5	12	891	203	130	3,046	2,976	6,022	1,556
Thredling	435	668	1	1	463	169	36	1,703	1,625	3,328	754
Wangford	2,454	2,810	9	64	1,179	1,071	560	6,583	7,022	13,605	3,204
Wilford	1,108	1,490	3	23	955	326	269	3,679	3,754	7,433	1,793
Bury St. Edmunds (Borough)	2,231	2,429	10	51	141	1,299	989	5,246	6,190	11,436	2,550
Ipswich . . do.	4,116	4,450	25	214	274	2,490	1,686	9,169	11,032	20,201	4,509
Sudbury . . do.	971	1,076	2	36	54	720	302	2,211	2,466	4,677	1,142
Totals	50,139	64,533	259	1,141	31,491	18,116	11,926	145,769	150,548	296,317	71,376

County Expenses, Crime, &c.—Sums expended for the relief of the poor:—1748-49-50 (annual average), 28,063*l.*; 1776, 56,804*l.*; 1783-84-85 (average), 69,407*l.* The sum expended in

	£	s. d.	
1801 was	119,963, being	11 4	for each inhabitant.
1811 ..	225,714 „	19 3	„
1821 ..	240,384 „	17 9	„
1831 ..	270,651 „	18 3	„

In each of the following years ending 25th March, the expenditure was as under:—

1835.	1836.	1837.	1838.	1839.	1840.
£224,904	£187,896	£136,870	£130,683	£145,871	£141,536

The expenditure in the last of the above years would average about 11*s.* 3½*d.* for each inhabitant. The total expenditure for the year ending 25th March, 1834, was 245,509*l.* The saving effected between that year and 1840 amounted to 123,175*l.*, or 45 per cent.; namely, under the head of relief and maintenance, 103,973*l.*, or 42 per cent.; in suits of law, &c., 6590*l.*, or 85 per cent.; and in miscellaneous expenses, 12,612*l.*, or 64 per cent. The number of poor-law unions is 16, comprising 507 parishes and a population of 281,320 according to the census of 1831: there are 2 parishes with a population of 11,436, which are not in any union. The number of paupers relieved during the quarter ending Lady-day, 1840, was 32,180 (4306 in-door, and 27,874 out-door), being 11 per cent. of the population, the proportion for England being 8·6 per cent. The illegitimate births in 1830 were 408, or 1 in 21; in England 1 in 20. The numbers affiliated in 1834-5 were 311; and in 1835-6, 209. Bastard children chargeable on the poors'-rate in 1835-6, 1558, or 1 in 190 of the whole population—in England 1 in 215. Lunatics and idiots chargeable on the same fund in 1836, 345, or 1 in 859;—in England 1 in 1033. Proportion per cent. of persons married under 21 years of age in 1840, 12·9;—in England and Wales, 9·6 for the two sexes.

The annual value of real property assessed to the property-tax in 1815, was 1,127,404*l.* The sum raised for poor-rate, county-rate, and other local purposes, for the year ending 25th March, 1833, was 300,016*l.*, levied

On land . . .	£247,543
Dwelling-houses . .	45,522
Mills, factories, &c. . .	5,868
Manorial profits, navigation, &c.	1,082
Total	£300,016

The amount expended was—

For the relief of the poor . .	£259,098
In suits of law, removal of paupers, &c. .	7,059
For other purposes . . .	33,900
Total money expended	£300,058

The county expenditure in 1834, exclusive of that for the relief of the poor, was 15,878*l.* disbursed as follows:—

Bridges, building, repairs, &c. .	£746
Gaols, houses of correction, and maintaining prisoners . . .	5782
Shire-hall and courts of justice, building, repairs, &c. . . .	294
Lunatic asylums . . .	903
Prosecutions . . .	2,509
Clerk of the peace . . .	854
Conveyance of prisoners before trial	1,225
Conveyance of transports . .	319
Vagrants, apprehending and conveying	23
Constables, high and special . .	666
Coroner	273
Payment of principal and interest of debt	1,000
Miscellaneous . . .	1,280
Total	£15,878

The county-rate levied at different periods, and the principal disbursements, are shown in the following table:—

	1805.	1811.	1821.	1831.	1838.
	£	£	£	£	£
Income .	25,557	12,923	17,138	12,457	17,765
Expenditure:—					
Bridges .	1,507	364	1,143	676	1,128
Gaols .	4,738	1,369	7,410	2,973	346
Prisoners' maintenance	779	980	1,185	4,534	3,959
Prosecutions	396	649	1,301	2,130	3,567
Constables and vagrants .	344	437	1,030	587	1,081

In 1839 the length of streets and highways, and the expenditure thereon, were as under:—

	Miles.
Streets and roads repaired under local acts	252
Turnpike roads	221
All other highways	2,859
	3,333

Amount of rates levied . . .		£25,480
Expended in repairs of highways	£25,371	
Law and other expenses .	466	
Total expenditure		25,838

The number of turnpike trusts in 1839 was 14; income from tolls, 9,940*l.*; from parish compositions, in lieu of statute duty, 57*l.*; and the total income was 10,337*l.*, the total expenditure for the same year being 10,583*l.* The assets, including arrears of income, amounted to 2,117*l.*; the debts to 34,288*l.* In 1836 the debt was equal to 2·8 years of the annual income;—the proportion for England being 4½ years; the proportion of unpaid interest to the total debt was 16 per cent., the average for England being 12 per cent.

In 1839 the church-rates amounted to 11,988*l.*; and 3,194*l.* applicable to the same objects was derived from other sources. In 1832 the sum derived from 'other sources' included 3,979*l.* from estates and rent charges. The sum expended for the purposes of the Establishment amounted to 14,443*l.* in 1839, out of which 7,164*l.* were expended on repairs of churches.

Crime.—Number of persons charged with criminal offences in the septennial periods ending 1819, 1826, 1833, and 1840:—

	1813-19.	1820-26.	1827-33.	1834-40
Total . .	1,300	1,913	2,631	3,170
Annual average	185	277	375	495

The numbers committed, convicted, and acquitted in each year from 1834 to 1839 were as under:—

	1834.	1835.	1836.	1837.	1838.	1839.	1840.
Committed	484	450	528	493	505	527	484
Acquitted	138	134	157	159	163	152	135
Convicted	346	316	371	334	342	375	349

In 1834 the proportion of persons committed, to the total population of the county, was 1 in 612; and in 1840, allowing for the increase of population, 1 in about 619.

Of 484 criminal offenders tried at the assizes and sessions in 1840, there were 24 charged with offences against the person; 40 with offences against property committed with violence; 401 (including 327 cases of simple larceny) with offences against property committed without violence; 3 with malicious offences against property; 3 for forgery and uttering base coin; and 13 for various misdemeanors. About eighty-two per cent. of the offences were those against property committed without violence; and about sixty-seven per cent. were cases of petty larceny. Sentence of death was recorded in 1 case, which was commuted into transportation for life. Of 349 offenders convicted, including the one above-mentioned, 5 were transported for life; 1 for above 15 years; 19 for periods varying from 10 to 15 years; 21 from 7 to 10 years; 36 for 7 years—making in all 83 offenders transported; 1 was imprisoned for above 2 years; 18 for a term exceeding 12 months; 51 for above 6 months; and 193 for 6 months and under; and 3 were whipped, fined, or discharged on sureties. The acquittals were 135 in number; in 15 cases there was no prosecution; in 38 no bill was found; and 82 persons were found not guilty on trial. Of the total number committed, 400 were males and 84 females: 177 males and 24 females could neither read nor write; 173 males and 53 females could read, or read and write imperfectly; 37 males and 4 females could read and write well; and the state of instruction of 13 males and 3 females was not ascertained. On an average of several years the proportion of uninstructed criminals in this county was 86·6 per cent.; those instructed 13·4 per cent.;—the average of the former for England and Wales being 89·3 per cent.

Savings Banks.—There are 13 of these institutions; and the number of depositors and amount of deposits on the

20th of November in each of the following years was as under:—

	1835.	1836.	1837.	1838.	1839.	1840.
No. of depositors	5,751	6,675	7,208	7,880	8,503	9,332
Am. of deposits	£178,591	£203,794	£217,915	£236,730	£255,789	£280,913

The distribution of the sums invested in 1830, 1834, and 1839, on the 20th of November in each year, was as under:—

	1830		1834.		1839.	
	Depositors.	Deposits.	Depositors.	Deposits.	Depositors.	Deposits.
Not exceeding £20	2,763	£20,795	3,115	£23,321	4,616	£33,427
,, 50	1,489	46,098	1,694	51,815	2,345	72,574
,, 100	722	48,871	789	54,868	933	65,466
,, 150	233	27,392	256	30,841	366	44,649
,, 200	103	17,920	121	20,412	192	32,268
Above . . 200	51	12,439	29	7,354	31	7,405
	5,371	173,541	6,004	187,611	8,503	255,789

The deposits of 200 friendly societies, not reckoned above, amounted, in 1840, to 22,158*l.*; and 8670*l.* were invested by 200 charitable institutions.

The state of the elective franchise in 1839-40 is shown in the following table:—

	E. div.	W. div.	Total.
Freeholders of every class . .	3,708	3,056	6,764
Copyholders and customary tenants	742	570	1,312
Leaseholders for life or for a term	40	22	62
50*l.* tenants at will	1,683	1,283	2,966
Trustees and mortgagees .	14	13	27
Qualified by offices . . .	134	131	265
Joint and duplicate qualifications	83	96	179
	6,404	5,091	11,495

Education.—Summary of the Returns made to Parliament in 1833:—

	Schools.	Scholars.	Total.
Infant schools	117		
Number of children at such schools; ages from 2 to 7 years:—			
Males . .		595	
Females . .		639	
Sex not specified .		879	
			2,113
Daily schools	961		
Number of children at such schools; ages from 4 to 14 years:—			
Males . .		11,733	
Females . .		10,317	
Sex not specified .		4,479	
			26,529
Schools . . .	1,078		
Total of children under daily instruction			28,642
Sunday schools	488		
Number of children at such schools; ages from 4 to 15 years:—			
Males . .		12,477	
Females . .		13,015	
Sex not specified .		4,738	
			30,234

The number of children in Suffolk, in 1833, between the ages of 2 and 15, may be computed at about 77,000, and between 4 and 14, at about 66,000. Eighty Sunday-schools, attended by 3130 children, were returned from places where no other schools existed; but in all other places in the county the children had also the opportunity, and many of them were in the habit, of attending daily schools as well; but to what extent duplicate returns were caused by this circumstance cannot be ascertained. Fifty-seven schools, attended by 3910 children, were both Sunday and daily schools, and thus far only can duplicate returns be discovered. Taking the numbers returned under daily instruction (28,642), and those attending Sunday-schools (30,230), the total number of children is 58,872, which falls short by some thousands of the total number of children between the ages of 2 and 15. The number of boarding-schools was 58.

Maintenance of Schools.

Description of Schools.	By endowment.		By subscription		By payments from scholars.		Subscrip. and payment from scholars.	
	Schls.	Scholars.	Schls.	Scholars.	Schls.	Scholars.	Schls.	Scholars.
Infant Schools	..	..	2	53	106	1,555	9	500
Daily Schools	92	2591	106	4,278	681	15,852	82	3808
Sunday Schools	23	1377	439	26,902	..	..	26	1961
Total...	115	3968	547	31,228	789	17,407	117	6269

According to the Reports of the Charity Commissioners, there are annual funds amounting to 3991*l.* applicable to the purposes of education; the income of endowed schools is 2972*l.*, and a sum of 1018*l.* is for educational purposes in schools not endowed.

The Schools established by Dissenters, included in the above table, are—

		Scholars.
Daily-schools . . .	15, containing	390
Sunday-schools . . .	105, .	9,199

The schools established since 1818 are—

Infant and other daily schools .	508, containing	13,763
Sunday-schools . .	231, .	16,281

Lending libraries were attached to 41 schools in 1833.

SUFFRAGAN. [BISHOP.]

SUGAR (French, *Sucre*; German, *Zucker*; Italian, *Zucchero*; Russian, *Sachar*; Spanish, *Azucar*; Arabic, *Sukhir*; Malay, *Soola*; Sanscrit, *Sarkara**). The sugar of commerce is a sweet crystallized substance, most commonly prepared from the expressed juice of the sugar-cane, of which there are several species [SACCHARUM, vol. xx., p. 299]; but sometimes from beet-root [BEET, vol. iv., p. 160], from the sap of one or more species of maple [ACER, vol. i., p. 79], and from other vegetable productions. Saccharine matter is indeed one of the most common of vegetable secretions [SECRETIONS, VEGETABLE, vol. xxi., p. 178]; but it is only from the above-mentioned substances that sugar has been extracted to any great extent as an article of commerce, and of these the sugar-cane is by far the most extensively used.

The chemical properties of various kinds of sugar are detailed in the succeeding articles (pp. 234, 235), which also notice most of the sources whence saccharine matter may be obtained. The latter part of the subject is more fully treated of in two papers read before the Society of Arts, in February, 1830, by their late secretary, Arthur Aikin, Esq., and published in the fifty-first volume of their 'Transactions.' A brief enumeration of the principal saccharine substances known to chemists, chiefly condensed from these papers, may assist the reader in taking a connected view of the subject.

Mr. Aikin commences his account of the substances which communicate the sensation of sweetness to the organs of taste, by alluding to the singular fact that the sensation may, under particular circumstances, be produced not merely by the contact of a sweet substance with the nervous papillæ of the tongue and palate, but also by the contact of a perfectly neutral or insipid substance, after the nerves have been over-excited by that sensation which is opposite to sweet. This opposite, he observes, is *bitter*; or, more properly speaking, *acerb*. This circumstance, which is analogous to a well-known optical phenomenon (alluded to in the account of ocular spectra, in the article SIGHT (vol. xxi., p. 506), is supposed to account for the reported sweetness of the waters of the Nile and some other rivers in the East; since natural pure water, which we should merely designate *fresh*, is, 'not metaphorically, but actually and literally, sweet and delicious as milk,' to the palates of travellers who have been compelled to drink of the bitter springs found in the sandy deserts of Syria and Arabia, and in those which insulate the valley of the Nile. The sensation of sweetness is produced not only by many vegetable and animal substances, but also by some of purely chemical character. Of the latter Aikin mentions the soluble salts of lead (one of which, the acetate, was formerly called *sugar of lead*); the hydrosulphates of silver and copper; and an earth which exists in the emerald, and which has been called glucine from its property of forming sweet salts with acids. [GLUCINIUM, vol. xi., p. 277.]

Of animal substances Aikin observes that the muscular parts of all quadrupeds, birds, and fishes, if boiled or roasted soon after death, have a decided though slight degree of sweetness; which sweetness disappears on the commencement of the spontaneous change which ends in putrefactive decomposition. That the sweet principle does not reside in the muscular fibre is presumed from the circumstance that it may be extracted from flesh by boiling water, in which

* The above list of synonymes is taken from M'Culloch's 'Dictionary of Commerce.' Dr. Benjamin Moseley (*Treatise on Sugar*, second edition, p. 4) gives a rather longer list, varying from this in a few minor points of orthography, and containing the following terms under which sugar is referred to by Greek and Roman writers:—*Μέλι καλάμινον*, Theophrastus; *Σάκχαρον*, Dioscorides; *Saccaron*, Pliny; *Σάκχαρι*, and *Μέλι καλάμινον*, Arrian; *Σάκχαρ*, Galen; and Ἅλς Ἰνδικός, P. Ægineta, from Archigenes.

muscular fibre is insoluble; but as Aikin was not aware of any attempts to obtain the sweet matter in a separate state, he could not tell whether it agrees in essential character with any of the other sweets obtainable from the products of animal and vegetable organization. Glycerin is a sweet substance obtainable from most of the fats or expressed oils, whether animal or vegetable, by the process of saponification. [SOAP, vol. xxii., p. 169.] In its purest state, glycerin is in the form of a sweet syrup, which is not capable of crystallizing or undergoing the vinous fermentation. The sweet taste of new milk is occasioned by a saccharine substance called sugar of milk, the proportion of which, in the milk of various animals, is shown in vol. xv., p. 218 [MILK], while its chemical composition is given in p. 235 of this volume. This substance has been, and we presume still is, made in considerable quantities in some parts of Switzerland, for medicinal purposes. It is, according to Aikin, made from the whey left after making cheese. The whey is first heated to separate the butter from it, and is then boiled down to the consistence of syrup, which is poured into earthen pots, and exposed to the sun until it is nearly solid. The mass is then put into water, and heated till the sugar is dissolved, and the insoluble impurities are separated by pouring the hot liquor through a linen filter. It is then clarified with white of egg, and is again evaporated. It deposits, on cooling, a whitish crystalline mass, which differs little from vegetable sugar, but is less soluble in water, and will not undergo the vinous fermentation, although it be mixed with yest. Beckmann, who notices the history of the invention of this substance in his 'History of Inventions' (vol. iv., p. 599, English edit. of 1814), describes the mode of preparing it from new milk; but he observes that the sugar so made is fatter, and more liable to spoil, than that given by milk from which the butyraceous and caseous parts have been carefully separated. The only other sugar of animal origin, mentioned by Mr. Aikin, is that found in the urine of persons suffering under the disease called *diabetes mellitus*. [DIABETES, vol. viii., p. 479.]

Honey-dew, or aphis-sugar, and the honey of the bee, are intermediate between animal and vegetable sugars; because, though derived from vegetable juices, they are modified by digestion in the stomachs of insects. Honey-sugar is described in p. 235 of this volume; and in the article on the properties of sugar, in the same page, is a notice of the formation of sugar from the starch contained in many vegetable productions. Among vegetables which contain sugar ready formed (though not in a crystallized or separate state), there are several trees from the sap of which it may be obtained in sufficient quantity for human use. Two of these—the sycamore and the birch—are natives of Britain; but the sugar which they yield is not sufficient to repay the expense of manufacture. The sugar-maple, which abounds in some parts of North America, yields sugar in such abundance as to be of considerable importance. Many trees of the palm family afford a sweet sap, which may be boiled down to a tolerably solid viscid sugar. [BORASSUS, vol. v., p. 173.] Palm-sugar is called *dibs;* and Mr. Aikin thinks that perhaps it is alluded to by Pliny under the name *dablan* (xiii. 7). For notices of manna-sugar, see MANNA, vol. xiv., p. 386, and pp. 235 and 236 of this volume.

Saccharine matter exists in many ripe fruits in great abundance, as is evident not only from their sweet taste, but also from the circumstance that it exudes from some, as the fig and the grape, in the process of drying. From the former of these, as well as from the date and the plantain, it appears that sugar has never been made, perhaps owing to the difficulty of extracting granulated sugar from a fruit containing so much mucilage. Attempts have been made to extract solid sugar from grapes, but without much success. M. Proust, a chemist in the service of the king of Spain, tried to accomplish this object, with the hope of preventing the annual waste of many thousand tons of grapes; but while he obtained a solid sugar of coarse quality, it was at too great an expense to bear competition with common sugar. Political troubles put an end to this experiment; but the manufacture of sugar from grapes was again tried in consequence of the loss of the French sugar colonies, under the encouragement of the French government. Great difficulty was experienced from the strong tendency of the juice, when expressed from the grapes, to ferment; from its liability to contract an empyreumatic flavour while boiling down; and from the difficulty of separating the tartar which all grape-juice contains. The two former difficulties were much lessened by the judicious application of sulphurous acid, but the last was not overcome; and at length the attempt to separate the sugar in a crystallized form was abandoned; and the juice, reduced to a thick syrup, was brought into extensive use as a substitute for sugar, until the return of peace rendered its use no longer necessary. Aikin states that white grapes were preferred for the purpose. The first process in the manufacture was the addition of sulphurous acid to the juice, either by stirring into the cold liquor sulphite of lime, in the proportion of 1 to 400 or 500 of the liquor; or by filling a tub with sulphurous acid gas, and then pouring the juice into it through a colander, so that it might be divided into a great number of streams, to facilitate the absorption of the gas. The liquor then remained quiet for a day or two, in which time much insoluble matter was deposited. The clear liquor, being drawn off, was then boiled; alone, if it had been mixed with sulphite of lime; or with the addition of some chalk, if sulphurous acid gas had been employed. After a partial evaporation, the syrup was clarified, either with blood, with white of egg, or with animal charcoal and white of egg, the latter being considered the best. The liquor, while boiling hot, was run through a filter, and subsequently boiled down to a thick syrup. When the sugar was required in a solid state, the syrup was boiled rather more than in the former case, and was kept in a cool place for a fortnight after boiling. At the end of this time it had the consistency of candied honey; and by subjecting it to pressure about one-third of its weight was obtained of soft sugar, of an agreeable flavour, but mealy, and apt to become moist in damp weather. It was also liable to curdle milk, and consequently unfit for many culinary purposes. The chemical composition of grape-sugar is given in pp. 234, 5. Aikin states that the *rob* of grapes, that is, the juice boiled down to the consistence of honey, has been long known in Syria and Egypt; and that Dr. Shaw, who, when in those countries, ascertained that two thousand quintals of it were annually exported to Egypt from the neighbourhood of Hebron alone, is inclined to attribute a very high antiquity to this preparation. He says further that Dr. Russell, in his 'History of Aleppo,' mentions it under the name of *dibbs* (being the same that is applied to date-sugar), and represents it as a common article of food at that place.

Several roots, particularly of the tuberous or fleshy kind, contain sufficient saccharine matter to be important, either for separating it in a pure state, or in the form of an extract of all the soluble ingredients of the root. Of all the latter class liquorice is one of the most important. See GLYCYRRHIZA GLABRA (vol. xi., p. 278), and *Liquorice Sugar*, in p. 235 of this volume. For the former purpose, attempts have been made upon several fleshy roots employed as food. Marggraf, a Prussian chemist, called public attention to the subject by a memoir printed in the 'Transactions' of the Academy of Berlin, for 1747. The roots he tried were the skirret (a variety of parsnep), the white beet, and the red beet. His experiments were resumed some years afterwards by M. Achard, at the desire of the Prussian government. Probably these and some other early experiments led, in some degree, to the subsequent introduction of the manufacture of beet-root sugar in France under M. Chaptal. [BEET, vol iv., p. 160.]

The above details show how many sources there are from which sugar might be obtained. None of them however, as far as experiment has shown hitherto, will bear comparison with the sugar-cane in point of cheapness; so that it is doubtful whether even beet-root sugar could enter into competition with that from the cane, unless aided by fiscal regulations.

Notices of Sugar and the Sugar-cane by antient writers.—It has been conjectured, although the opinion is not generally adopted, that the Hebrew word used in several places in the Old Testament, and rendered by our translators *calamus* in some places, and in others *sweet cane*, refers to the sugar-cane. Whatever the sweet cane alluded to may have been, it was apparently an article of merchandise in early times; and, as it is mentioned as coming from a far country, it was probably not a production of either Egypt or Judæa. (See *Exod.*, xxx. 23; *Sol. Song*, iv. 14: *Is*, xliii. 24; *Jer.*, vi. 20; *Ezek.*, xxvii. 19.) Dr. Moseley (*Treatise on Sugar*, second edit., pp. 127-136) has combated this conjecture at considerable length. He also opposes the idea of there being any connection between the term *shecar* or *shuker*, which is commonly rendered in the

English version 'strong drink,' and the produce of the sugar-cane. This supposition is noticed elsewhere [SACCHARUM, vol. xx., p. 299]; and also the allusion of Herodotus to 'honey made by the hands of men.' The frequent application of the name honey to sugar by later writers among the antients renders it highly probable that sugar is here meant: and if so, unless we suppose the sacred writers to have alluded to it, Herodotus is probably the earliest author who mentioned sugar. Nearchus, Alexander's admiral, relates that 'the reed (in India) yields honey without bees;' but his statement, while it carries back the account of the sugar-cane to more than three centuries before the Christian æra, has come down to us through Strabo (694, Casaub.), who lived much later. Theophrastus, whose account is very nearly as old as that of Nearchus, describes three kinds of honey—from flowers, from the air (apparently honey-dew), and from canes or reeds; and in another place (*De Causis Plant.*, lib. vi., c. 16, ed Heinsii), quoted by Dr. Moseley, he describes a reed or cane that grew in moist places in Egypt, which was sweet even to the roots. Moseley quotes this passage, although it appears doubtful whether such a reed really existed, 'because,' he observes, 'other writers have mentioned this reed with sweet roots, probably from him; and many have supposed the sugar-cane was the reed alluded to, though erroneously described.' Thus Erastosthenes (about B.C. 223) as quoted by Strabo (693, Casaub.), speaks of the sweetness of the roots of Indian plants, especially of reeds. Varro also, about B.C. 68, has a passage which Moseley translates as follows:—'The Indian reed does not grow to a large tree; from its viscid roots a liquor is pressed, to which honey cannot be compared for sweetness.' Even so late as A.D. 218,* Solinus (*Polyhistor.*, cap. lii.) repeated the same blunder in a passage of which part was taken from Pliny; but Moseley says that neither Pliny nor Herodotus (who also mentions the very large reeds described by Solinus) says anything about the sweetness of their roots. From some passages in early writers it would seem that the juice of the cane was used as a drink. Pliny's account of the Fortunate (now called the Canary) Islands (vi. 32) alludes to 'trees resembling the *Ferula*, from which water may be expressed; the water from the black sort is bitter, but that from the white grateful to drink.' Moseley quotes also a passage from the 'Periegesis' of Dionysius Afer (a work of little value for geographical information), to the effect that the Indians drank the juice of the Indian cane. The like is stated in the 'Periplus of the Erythræan Sea,' supposed to have been written by Arrian early in the second century, of a nation bordering on the Red Sea, who drank 'honey of the reed, called sugar.' The term 'honey of canes,' which appears to indicate a fluid or semi-fluid consistency, was also used by Avicenna, as late as the tenth century; although he also distinctly mentions sugar under another name, as will be seen below.

Dioscorides, about the period of the reign of Nero, is said to be the first writer who uses the word *Saccharum* (σακχαρον), or sugar; but while he gives an accurate description of it, he was evidently unacquainted with the process by which it was prepared. He says, 'There is a sort of concreted honey, which is called sugar, found upon canes in India and Arabia Felix: it is in consistence like salt, and it is brittle between the teeth like salt.' Seneca, in his eighty-fourth Epistle, speaks of sugar as honey found on the leaves of canes, which is produced by the dew, or the sweet juice of the cane itself, concreting; thereby showing the like ignorance of its real character. Pliny (*Hist. Nat.*, xii. 8) speaks of sugar as brought from Arabia, and better from India. 'It is,' he says, 'honey collected from canes, like a gum, white, and brittle between the teeth; the largest is of the size of a hazle-nut. It is used in medicine only.' Galen, in the second century, gives a description of sugar almost identical with that of Dioscorides, excepting that he says nothing of its brittleness and resemblance to salt. These qualities are however again mentioned by Paulus Ægineta, in the seventh century, who, following Archigenes, an earlier writer, describes sugar as 'the Indian salt, in colour and form like common salt, but in taste and sweetness like honey' (ii. 54). He recommends that a piece be kept in the mouth, to moisten it, during fevers; from which it may be supposed that the sugar then known was in the form of candy. The same recommendation, with a similar description of sugar, was copied by Avicenna. Macpherson (*Annals of Commerce*, vol. i., p. 162, note) refers to an Indian stone described by Megasthenes (Strabo, 703, Casaub.), as sweeter than figs or honey, thinking that it must have been sugar-candy; but Megasthenes speaks of this stone 'being dug out of the ground,' and it is difficult to conjecture what he can mean.

* This date is given by Dr. Moseley (*Treatise on Sugar*, second edit., p. 15), but his æra is uncertain. [SOLINUS, vol. xxii., p. 208.]

Such notices might be extended much further, but enough has been stated to show that sugar was known, and was an article of commerce, at least as early as the commencement of the Christian æra; and also to prove that its origin was very imperfectly understood by antient Greek and Roman writers. Dr. W. Falconer, in a 'Sketch of the History of Sugar in Early Times, and through the Middle Ages,' published in the fourth volume of the 'Memoirs of the Literary and Philosophical Society of Manchester,' in 1796, has given quotations from several early authors not mentioned above; and Dr. Moseley's 'Treatise on Sugar' also goes very minutely into its early history, and gives the opinions of early medical writers respecting its use, which, in the period above alluded to, appears to have been chiefly medicinal. Although more than one writer speaks of sugar as coming from Arabia as well as India, he conceives that, at any rate when in the form of candy, it could not have been made in the former country. Indeed the early Arabian writers themselves speak of sugar as coming from India. It appears probable that the white sugar-candy of China, which has been very long celebrated for its excellence, was the Indian salt of the Roman authors.

Introduction of Sugar into Europe, America, and the West Indies.—Dr. Falconer, after giving passages from Greek, Roman, and Arabian writers down to the end of the tenth century, presents extracts from the historians of the crusades, who describe the sugar-cane as met with by the Crusaders in Syria. One of these, Albertus Agnensis, about the year 1108, says that 'sweet honied reeds,' which were called *Zucra*, were found in great quantity in the meadows about Tripoli. These reeds were sucked by the crusaders' army, who were much pleased with their sweet taste; and our author gives the following account of their use by the inhabitants of the country:—'This plant,' he says, 'is cultivated with great labour of the husbandmen every year. At the time of harvest they bruise it, when ripe, in mortars, and set by the strained juice in vessels till it is concreted in the form of snow or of white salt. This, when scraped, they mix with bread, or rub it with water and take it as pottage; and it is to them more wholesome and pleasing than the honey of bees.' This is, as far as we are aware, the oldest description extant of the process of extracting sugar from the cane. It appears to have been practised at that time to a considerable extent; for the same author, in his account of the reign of Baldwin, in 1110, mentions the capture by the crusaders of eleven camels laden with sugar. Another of these historians, Jacobus de Vitriaco, in 1124, says that in Syria reeds grow that are full of honey; by which he understands a sweet juice which, by the pressure of a screw-engine, and concreted by fire, becomes sugar. This was the first account known to Dr. Falconer of the use of heat or fire in preparing sugar. About the same time William of Tyre speaks of sugar as made in the neighbourhood of Tyre, and sent from thence to the farthest parts of the world. As early as the time of the emperor Frederick Barbarossa (the date 1170 is given by Falconer), Hugo Falcandus speaks of sugar as produced in great quantity in Sicily, and used in two states: either boiled down to the consistence of honey, or boiled further, so as to form a solid body of sugar. About 1306, according to Marinus Sanutus, sugar was made in the countries subject to the Sultan, and also in Cyprus, Rhodes, Amorea, Marta,* Sicily, and other places belonging to the Christians.

It is very difficult to trace the progress made in introducing the sugar-cane, and the process of extracting sugar from it, into the islands of the Mediterranean, into Italy, and into Spain; but most authorities agree that these benefits were derived from the Arabs, and were in some degree connected with the increased communication with the East occasioned by the Crusades. M'Culloch, while he admits that the Crusades tended to spread a taste for sugar through the Western world, considers that there can be no doubt of

* Macpherson, in quoting this passage (*Annals of Commerce*, vol. i., p. 491), observes, in a note to the names Amorea and Marta, 'These are apparently the Morea and Malta; but I cannot at present determine the exact time when the name of Morea superseded that of Peloponnesus.' Instead of understanding, from the account of Sanutus, that sugar was cultivated in Sicily and other Christian countries, he reads, that it would grow there if there were a demand for it; and adds, in a note, that Sanutus did not know that it had been cultivated in Sicily long before.

'ts having been cultivated in modern Europe antecedently to the æra of those expeditions, as well as imported by the Venetians, the inhabitants of Amalfi, and others, who carried on a commercial intercourse with Alexandria and other cities in the Levant. Dr. Moseley states, on the authority of a French 'Essai de l'Histoire du Commerce de Venise,' that sugar was certainly imported into Venice as early as 991. We do not know precisely when sugar was first made in Sicily; but, according to the account given by Lafitau, a Jesuit, it must have been before 1166: for he states that in that year William II., king of Sicily, gave a mill for grinding sugar-canes, with all its rights, members, and appurtenances, to the monastery of St. Bennet. It is also stated by Venetian historians that in the twelfth century Venice could import sugar cheaper from Sicily than from Egypt. The manufacture of sugar was probably introduced into Spain by the Moors, some say from Africa. The cane is supposed to have been first planted in Valencia, and afterwards in Granada and Murcia. A very interesting account of the sugar manufacture, as practised in Valencia in 1664, is given by Mr. Francis Willughby, an English traveller who visited Spain in that year. (Ray's *Travels*, second edit., 1738, vol. i., p. 409, &c.) About 1420 the Portuguese took the sugar-cane from Sicily to Madeira, and, probably during the fifteenth century, it was carried from Spain to the Canaries. Anderson relates, under the year 1503, on the authority of Morisot, 'that, the Canary Isles beginning to be frequented, there arrived two Zealand ships at Campveer, laden with Canary sugars.' 'From these origins,' adds Dr. Moseley, 'the cultivation of the sugar-cane, and the art of making sugar, were extended by different nations of Europe to the West Indian islands and the Brazils.'

It would be tedious to enter into an examination of the confused accounts which we possess of the gradual extension of the culture and manufacture of sugar on the continent and islands of the western hemisphere, or to repeat the equally confused and often contradictory statements of those writers who have examined the question as to whether the sugar cane was or was not indigenous to the New World. Much may be found on this subject in the treatises of Moseley and Porter. Aikin conceives that many of these accounts may be reconciled by supposing the sugar-cane to have been cultivated in some cases as an esculent garden vegetable, the stem being eaten, or rather sucked or chewed, in a raw state, after being simply peeled, before it was cultivated for the purpose of manufacturing sugar. Wherever the sugar-cane may have been indigenous, there is no reason to question the fact that the manufacture of sugar, derived originally from China and India, was introduced into the western world by the Spanish and Portuguese. A few isolated facts respecting the production of sugar in the sixteenth and seventeenth centuries will indicate the changes which the trade in this important article has undergone.

In Hispaniola, or St. Domingo, there were, as early as 1518, twenty-eight sugar-works, established by the Spaniards. Peter Martyr, who gives this information, remarks on the extraordinary growth of the cane in that island; which, for a long period, afforded the principal supply of sugar to Europe. Hawkins brought sugar from Hispaniola to England in 1563.

Anderson, in an account compiled from Guicciardini, of the commerce of Antwerp about the year 1560, states that Antwerp received sugar at that time from Spain,—which had it from the Canaries; and also from Portugal, the latter country deriving it from S. Thomé, or St. Thomas, and other islands on the African coast, and from Madeira. Sugar was also an article of import from Barbary.

In the island of St. Thomas, just alluded to, sugar was made, according to Moseley, much earlier than in the West Indies. He states, on the authority of Dapper, that the Portuguese had sixty-one sugar-works in the island, before the Dutch destroyed them in 1610. A few years later, Heylin, in his 'Cosmographie,' stated that forty ships were annually loaded with sugar from this island; for the production of which there were seventy 'ingenios,' or sugar-houses, employing from 200 to 300 slaves in each.

Whatever may have been the precise period of the commencement of the English sugar-manufacture in Barbadoes, Anderson states that in 1627, and for several years later, the Portuguese supplied most parts of Europe with Brazil sugars. About 1650 the British planters in Barbadoes appear to have been realising property very rapidly by the raising of sugar; they having obtained, a few years before, valuable information from Brazil respecting the culture and process of extracting sugar from the cane. In 1670 Sir Josiah Child (quoted by Anderson) alluded to the decline of the Portuguese sugar trade, saying, 'As we have already beat their Muscovado and Paneal sugars quite out of England; and their whites we have brought down in all these parts of Europe, in price, from seven and eight pounds per hundred-weight, to fifty shillings and three pounds. And we have also much lessened their quantities; for whereas formerly their Brazil fleets brought one hundred to one hundred and twenty thousand chests of sugar, they are now reduced to about thirty thousand chests, since the great increase of Barbadoes.' M'Culloch states that in 1676 the sugar trade of Barbadoes is said to have attained its maximum, being then capable of employing 400 vessels, averaging 150 tons burden. [SUGAR TRADE, p. 237.]

Cultivation of the Sugar-Cane.—The botanical characteristics of the sugar-cane are given under SACCHARUM (vol. xx., p. 299), where also the principal species are mentioned. As to the modes of culture, much information is contained in Edwards's 'History of the West Indies,' and in Porter's treatise on 'The Nature and Properties of the Sugar-Cane.'

The height attained by the canes, their colour, the length of their joints, and many other particulars, vary with different species, with the character of the soil, and with the modes of culture adopted. The stems vary in height from eight feet up even to twenty feet, and are divided by prominent annular joints into short lengths. Long narrow leaves sprout from each joint; but as the canes approach maturity, all those from the lower joints fall off. The outer part of the cane is hard and brittle, but the inner consists of a soft pith, which contains the sweet juice; this juice being elaborated separately in each joint, independently of those above and below it. The canes are usually propagated by slips or cuttings, consisting of the top of the cane, with two or three of the upper joints, the leaves being stripped off. These are planted either in holes dug by hand, or in trenches formed by a plough, about eight to twelve inches deep; the earth being banked up upon the margin, and well manured. When the plough is used, it is returned along the furrow, so that the earth may be thrown up on each side of the trench. The distance between the holes or trenches must be such as to afford free access of air to the plants, and convenient space for the labourers employed in tending them and clearing the ground from weeds. Three feet between the rows, and two feet between the holes in the rows, is about the minimum; but when the horse-hoe is used to keep the ground clear from weeds, the above distances must be increased to five feet and two and a half feet respectively. In this matter however there is much difference on different plantations. Two or more slips are laid longitudinally at the bottom of each hole, and covered with earth from the banks, to the depth of one or two inches. In about a fortnight the sprouts appear a little above the earth, and then a little more earth from the bank is put into the hole; and as the plants continue to grow the earth is occasionally filled in, by a little at a time, until, after four or five months, the holes are entirely filled up. The time required for bringing the canes to perfection varies much under different circumstances; and many planters disregard system as to the time of planting, performing that operation rather at the most convenient than at the most seasonable time. From August to November is however generally considered the best time for planting in the British West Indies; and about March and April is perhaps the most generally approved time for cutting the canes, although that operation is sometimes performed through a great part of the year. The maturity of the cane is indicated by the skin becoming dry, smooth, and brittle; by the cane becoming heavy; the pith grey, approaching to brown; and the juice sweet and glutinous. The canes which grow immediately from the planted slips are called *plant-canes;* but it is usual, in the West Indies, to raise several crops in successive years from the same roots; the canes which sprout up from the old roots, or *stoles*, being called *rattoons*. The rattoons are not so vigorous as the original plant-canes; but they afford better sugar, and that with less trouble in clarifying and concentrating the juice. The old practice of the West Indian colonists was to plant one-third of the cane-grounds every year, so as to obtain one crop from plant-canes and two from rattoons; but latterly more dependence has been placed upon rattoons. Some planters have, under favourable

circumstances, raised rattoon crops for more than twenty years successively, from the same stoles. The canes should be cut as near the ground as possible, because the richest juice is found in the lower joints; and, after cutting them, it is considered well to cut the stumps down a few inches below the surface of the ground, and to cover them up with mould. One or two of the top joints of the cane are cut off, and the remainder is divided into pieces about a yard long, tied up in bundles, and carried immediately to the mill. The upper branches of the cane are used as food for cattle, and the remainder of the waste forms a valuable manure, for which purpose the *trash* or waste from the mill is admirably suited, though much of it is usually consumed as fuel.

The sugar-cane is liable to the attacks of many destructive insects; of which a minute account was communicated to the Society of Arts, in 1827 and 1829, by the Rev. Lansdown Guilding, of Kingstown, St. Vincent, in the West Indies, which, with plates of some of the insects, was published in the forty-sixth and forty-seventh volumes of the Society's 'Transactions.'

Preparation of Raw or Muscovado Sugar.—The operation of cutting the canes is so adjusted as to keep pace with the action of the mill by which the juice is to be pressed out; so that the canes may be crushed or ground while quite fresh. In the East Indies mills of very rude and imperfect construction are used; some of them resembling mortars, formed of the lower part of the trunks of trees, in which the canes are crushed by the rolling motion of a pestle, which rests in an inclined position against the side of the mortar, and is moved by oxen yoked to an horizontal bar connected with it. The expressed juice runs off by a hole bored obliquely from the lower part of the mortar-like cavity, and is conducted by a spout to a vessel placed to receive it. In order to make such a mill effective, it is necessary to cut the cane into very small pieces. Dr. Ure gives engravings of two of these machines; in one of which the driver of the oxen, and in the other the man who feeds the mill also, rides upon the horizontal bar attached to the pestle. These mills are not portable, it being necessary that the stump of which the mortar is formed should be firmly fixed in the ground. Others are capable of being moved from place to place, so that they may accompany the movements of the cane-cutters. One of these consists of two vertical rollers of hard wood, having, near their upper ends, endless screws, or spiral ridges, so fitting into each other that both rollers may revolve when rotatory motion is applied to either. These are mounted in a strong frame, which may be fixed in any place by driving piles into the ground, and wedges are used to regulate the position of the bearings or axes of the rollers, so as to adjust them to a greater or less distance apart. The axis of one of the rollers is prolonged vertically above the framing, and carries a beam to which oxen are yoked to turn the mill. This appears to be the prototype of the vertical mill long used in the West India colonies; and another, still simpler, consisting of two grooved rollers placed horizontally in contact with each other, and turned by the power of men applied to levers at their ends, appears, in like manner, to be the rude original of the improved horizontal mills introduced of late years.

The common vertical cane-mills of the West Indies consist of three rollers, mostly of wood, with narrow strips of iron attached to their faces, so as to form, by the spaces left between them, straight grooves extending from end to end of the rollers. These are usually from twenty to twenty-five inches in diameter, and about forty inches long; and they are placed side by side in a strong frame, with contrivances for varying, in a slight degree, their distances from each other. The moving-power is applied to the middle roller, and communicated from it to the others by cogged wheels. Any sufficiently powerful prime-mover may be used to work the mill; but wind is the least advantageous, on account of its uncertainty, since it is highly important that all the operations should go on without interruption. Therefore, when wind is used as a moving-power, it is well to have also apparatus for working the mill by mules or oxen, should the former fail. Of late steam-engines have been adopted with good effect in some of the sugar-works in the West Indies. In using the mill, a negro applies the canes in a regular layer or sheet to the interval between the first and second rollers, which seize and compress them violently as they pass between them. The ends of the canes are then turned, either by another negro on the opposite side to the feeder, or by a framework of wood called a *dumb returner*, so that they may pass back again between the second and third rollers. As these are placed nearer together than the first and second, they compress the canes still more, so that on leaving them they are reduced to the form of dry splinters, which are called *cane-trash*, and are used as fuel in heating the vessels for evaporating the juice. Channels are added to receive the liquor expressed from the canes, and to conduct it to the vessels in which it is to undergo the succeeding operations.

The construction of this mill is very defective, since it is impossible to supply the canes to the rollers in so uniform a layer as to prevent them crossing each other. They become therefore unnecessarily crushed and broken, so that the liquor is rendered foul, and the rollers are exposed to irregular and destructive wear. These evils are obviated by the improvement of placing the rollers in a horizontal position, and feeding the mill by sliding the canes gradually from an inclined board. The rollers are made very accurately of cast-iron, hollow, and fluted or grooved on the surface. Such improved sugar-mills have been described and represented by Professor Barlow, in the treatise on Machinery and Manufactures, forming part of the 'Encyclopædia Metropolitana,' by Porter, in his work on the Sugar-Cane, and by Dr. Ure, in his 'Dictionary of Arts,' &c.; from the latter of which works the following description is condensed. The three rollers are not placed in the same plane, but are arranged in a triangular form, the periphery of the upper roller being very nearly in contact with the two lower rollers, which are also very near together. They are mounted in an iron framing, resting upon a massive foundation of masonry, and having the necessary provisions for adjusting the relative positions of the rollers. The two lower rollers, which are called respectively the feeding and delivering rollers, have small flanges at their ends, between which the top roller is placed, so that the pressed canes, or *begass*, may not be able to escape from the rollers and clog the machinery. The rollers are made from two inches and a quarter to two inches and a half thick, and are generally fluted, sometimes in a diagonal direction, to enable them the better to seize the canes from the feed-board. It is however, observes Dr Ure, on the whole considered better to flute the feeding-roller only, leaving the top and delivering rollers plain. When the top roller is fluted, it should be very slightly, for after the work of a few weeks, its surface becomes sufficiently rough to bite the canes effectively. The practical disadvantage of fluting the delivering roller is in the grooves carrying round a portion of the liquor, which is speedily absorbed by the spongy begass, as well as in breaking the begass itself, and thus causing great waste. The feed-board is an inclined plane, commonly of cast-iron, the edge of which is nearly in contact with the feeding roller. The space between the feeding roller and the top roller is usually about half an inch; but the space between the latter and the delivering roller is much less. The delivering board, which receives and conducts away the *trash* of the cane, is also of cast-iron, sloping downwards from the delivering roller, with which its edge is in close contact, so that it may detach any portions of trash or begass that may adhere to the delivering roller, and which, if not detached, would become mixed with the expressed liquor. The rollers are set in motion by toothed gear, and suitable channels and receptacles are provided for receiving and conducting away the cane-juice. In some cases the liquor is raised from the gutter of the mill-bed by pumps connected with and worked by the machinery of the mill; but it is essential that such pumps should be worked very slowly, lest the agitation of the liquor should favour fermentation. Where circumstances render such an arrangement practicable, labour may be saved by placing the crushing-mill on a high level, so that the liquor may run from it to the vessels in which it is to be purified, by inclined gutters. The dimensions given by Dr. Ure as those of the most approved horizontal mills, worked by steam-engines of from eight to twelve horse-power, are, length of rollers, four feet to four feet eight inches, and diameter from twenty-five to twenty-eight inches. The surface speed of the rollers is 3·4 or 3·6 feet per minute. The rate at which juice may be expressed varies according to circumstances; but it is stated that in Demerara a well-constructed engine and mill will produce

about a hundred gallons of liquor per hour for each horse-power.

Cane-juice, as expressed by the mill, is an opaque, slightly viscid fluid, of a dull grey, olive, or olive-green colour, of a sweet balmy taste, and of a specific gravity varying from 1·033 to 1·106. It holds in suspension particles of solid matter from the cane, a considerable portion of which is separable by filtration or repose. This solid matter consists of fragments of the cellular parenchyma of the cane, its fibres, and bark, mixed with a very abundant greenish substance, like that called *chlorophyle* by chemists, which forms the colouring-matter of leaves. The juice is so exceedingly fermentable, that in the climate of the West Indies it would often run into the acetous fermentation in twenty minutes after leaving the mill, if the process of clarifying were not immediately commenced. As this would be extremely injurious, it is very important so to proportion the size of the clarifying apparatus to the power of the mill, that the juice may be conducted immediately to it, as fast as it is expressed from the canes.

The processes followed in the East Indies for separating the sugar from the cane-juice are very tedious and imperfect, and may be dismissed with a very brief notice. The liquor, after being strained so as to separate the coarser feculencies, is boiled down in a range of open boilers heated by a long flue, into a thick inspissated juice, the scum which rises during the operation being removed. When it is sufficiently evaporated, it is removed into earthen pots to cool, and in these it becomes a dark coloured, soft, viscid mass, called *goor*, or *joggery*. Sometimes a little quick-lime is added to the juice before boiling, which, by partly clarifying it, renders it capable of being formed into cakes or lumps. In general however, if intended for subsequent clarification, the juice is merely boiled down, and sold in pots, in a granular honey-like state, to the boilers or refiners. These separate much of the molasses or uncrystallizable part of the juice, by putting the goor into a coarse cloth and subjecting it to pressure. The sugar, which in this state is called *shucker* or *khand*, is further purified by boiling it with water, with the addition of an alkaline solution and a quantity of milk. When this has been continued until scum no longer rises upon the liquor, it is evaporated, and sometimes strained, and afterwards transferred to earthen pots or jars, wide at the top, but coming to a point at the bottom, which is perforated with a small hole, that, at the commencement of the operation, is stopped with the stem of a plantain-leaf. After it has been left for a few days to granulate, the holes in the pots are unstopped, and the molasses drains off into vessels placed to receive it. The sugar is rendered still purer and whiter by covering it with the moist leaves of some succulent aquatic plant, the moisture from which drains slowly through the sugar, and carries with it the dark-coloured molasses. After several days, the leaves are removed, and the upper part of the sugar, which has been most purified, is taken away and dried in the sun. Fresh leaves are then added, by which another layer of sugar is whitened in like manner; and the operation is repeated until the whole mass is refined. The sugar thus prepared is called *chenee*, and is that which is commonly brought to England.

A similar process to the above is said to be practised in Cochin China, by making a pile of brown sugar and of slices of the cellular part of the plaintain stem, in alternate layers. The colouring-matter of the sugar is thus absorbed by the plaintain, leaving the sugar very pure and white. From sugar so prepared the fine white sugar-candy of that country is made.

The separation of the sugar from the cane-juice is effected in a much simpler manner in the West India colonies. The juice is conducted by gutters from the mill to one or more large flat-bottomed coppers or open pans, called *clarifiers*, which usually contain from three hundred to four hundred gallons each, but sometimes as much as a thousand gallons. Each of these clarifiers is placed over a fire, which may be regulated or extinguished by a damper; and each is supplied with a stop-cock or siphon for drawing off the liquor. When the clarifier is filled with juice, a little slaked lime is added to it; the lime, which is called *temper*, being, in most cases, previously mixed with a little cane-juice to the consistence of cream. The quantity of lime varies with different juices, and should be very carefully adjusted, as too much is very injurious to the sugar. Dr. Ure remarks, respecting this process, 'If an albuminous emulsion be used to promote the clarifying, very little lime will be required; for recent cane-liquor contains no appreciable portion of acid to be saturated.' 'In fact,' he proceeds, 'the lime and alkalis in general, when used in small quantity, seem to coagulate the glutinous extractive matter of the juice, and thus tend to brighten it up; but if an excess of temper be used, the gluten is taken up again by the strong affinity which is known to exist between sugar and lime. Excess of lime may always be corrected by a little alum-water. Where canes grow on a calcareous marly soil, in a favourable season the saccharine matter gets so thoroughly elaborated, and the glutinous mucilage so completely condensed, that a clear juice and a fine sugar may be obtained without the use of lime.' As the liquor in the clarifier becomes hot, the solid portions of the cane-juice coagulate, and are thrown up in the form of scum. The heat should be urged nearly to the boiling-point, but the liquor in the clarifier should not actually boil. Porter says it should never exceed a heat of 210° Fahr. The proper heat is indicated by the scum rising in blisters and breaking into white froth, which commonly happens about forty minutes after the fire is lighted. The damper is then closed, and the fire dies out; and after an hour's repose, the liquor is ready for removal to the first of the evaporating pans. It is drawn off either by a cock or a siphon, in such a manner as not to disturb the scum, which subsides unbroken, and is removed from the clarifier before another charge of cane-juice is put into it. The clarified juice is bright, clear, and of a yellow wine colour.

From the clarifier the purified juice is transferred to the largest of a series of evaporating coppers or pans, three or more in number, in which it is reduced in bulk by boiling. The largest of these should be of sufficient size to receive the whole contents of the clarifier; but the others may become gradually smaller, on account of the diminished bulk of the liquor, by evaporation, as it is removed into each of them in succession. These evaporators are placed over a long flue, heated by a fire at one end, over which the smallest of the coppers, called the *teache*, is placed. In the process of boiling, impurities are thrown up in the form of scum, which is carefully removed; and sometimes that from the smaller pans is allowed to return, by a channel provided for the purpose, into the largest pan, or *grand copper*. If, during the evaporation, it be perceived that the liquor is not sufficiently clear, some lime-water is added to it, for the same purpose as the temper was originally applied to the juice in the clarifier. In the least and smallest of the evaporating coppers, called the *teache*, the liquor is boiled down to as thick a consistency as is considered necessary for granulation; this point being most commonly ascertained by observing to what length a thread of the viscid syrup may be drawn between the thumb and finger. For this purpose a drop of the syrup is taken between the thumb and forefinger, and drawn into a thread until it snaps asunder. When it has done so the portion suspended from the finger shrinks up, so as to remain at a greater or less length, according to the degree to which the syrup has been evaporated. The proper state is indicated by a thread of from half an inch to a quarter of an inch long. This trial by the *touch*, whence the teache is supposed to derive its name, is very imperfect; for it sometimes happens that the syrup may have the required tenacity, and yet not be in a good state for crystallizing. The latter point may be better ascertained by observing the incipient granulation of the syrup on the back of a ladle dipped in the teache. More perfect tests have been suggested, but Dr. Ure observes, that tenacity and granular aspect 'will continue to constitute the practical guides to the negro boiler, till a less barbarous mode of concentrating cane-juice be substituted for the present *naked teache*, or *sugar frying-pan*.' He adds the following remarks, illustrative of the evils of this practice:—'That weak sugars are such as contain an inferior proportion of carbon in their composition was first deduced by me from my experiments on the ultimate analysis of vegetable and animal bodies, an account of which was published in the 'Philosophical Transactions' of the Royal Society for 1822. Since then Dr. Prout has arrived at results confirmatory of my views. See 'Philosophical Transactions' for 1827. Thus he found pure sugar-candy, and the best refined sugar, to contain 42·85 parts of carbon per cent.; East India sugar-candy, 41·9 parts; East India raw sugar in a thoroughly dry state, but of a low quality, 40·88; manna sugar, well refined, 28·7; sugar from Narbonne honey, 36·36; sugar from starch, 36·2. Hence, by

caramelizing the syrup in the *teache*, not only is the crystallizable sugar blackened, but its faculty of crystallizing is impaired, and the granular portion is rendered weaker.' The thermometer, though useful, will not, he states, be a sure guide in determining the proper moment for *striking*, or emptying the teache, because a viscous syrup, containing much gluten and sugar, altered by lime, requires a higher temperature to enable it to granulate than a pure saccharine syrup.

The concentrated syrup is laded, or *skipped*, from the teache, either immediately into open wooden boxes called *coolers*, or into a large cylindrical cooler, about six feet wide and two deep, from which it is afterwards transferred to the smaller coolers, or rather crystallizing or granulating vessels. The latter plan seems preferable, because when successive portions or skippings of syrup are poured into the same vessel, the saccharine particles of one portion agglomerate round those of the preceding skipping, so that a larger grain is produced. The smaller wooden coolers, of which there are commonly six, are usually rectangular, about seven feet long, five or six feet wide, and one deep. The large mass of sugar in each cooler is favourable to the production of large crystals, because it occasions the syrup to cool very slowly.

In the last-mentioned vessels the sugar is brought to the state of a soft mass of crystals, imbedded in molasses, or thick, viscid, but uncrystallizable fluid. The separation of this fluid is the next part of the process, and is performed in a building called the *curing-house*. This is a large building, the floor of which is excavated to form the molasses reservoir, which is lined with sheet-lead, boards, or cement. Over this cistern is an open framing of joists, upon which stand a number of empty casks, or sugar hogsheads, called *potting-casks*. Each of these has eight or ten holes bored through the lower end, and in each hole is placed the stalk of a plantain-leaf, which is long enough to descend a few inches below the level of the joists, and to rise above the top of the cask. The soft concrete sugar is removed from the coolers into these casks, in which the molasses gradually drain from the crystalline portion, percolating through the spongy plantain-stalks, which act as so many drains to convey the liquid to the cistern beneath. With sugar of average quality three or four weeks is sufficient for this purpose, but sometimes a longer time is necessary. If the sugar be removed too early from the cooler, which Porter thinks is often the case, a portion of crystallizable syrup is lost, by its running away with the molasses. Most accounts describe the curing-house as an *airy* building; but Dr. Ure says "that it should be close and warm, to favour the liquefaction and drainage of the viscid caramel.

When it leaves the curing-house the sugar is packed in hogsheads for shipment as *raw*, *brown*, or *muscovado sugar*; and in this state it is commonly exported from our West Indian colonies. As the molasses is very imperfectly separated from the crystallized sugar, a considerable diminution of weight takes place subsequent to the shipment, by the drainage from the hogsheads. This waste has been estimated to amount to no less than 12 per cent., or more than 27,000 tons annually, upon the sugars of the British colonies. The loss upon French colonial sugars used to be much greater even than this. Dr. Ure states, on the authority of Dutrone, that of 120,000,000 lbs. of raw sugar which were annually shipped by the planters of St. Domingo, only 96,000,000 lbs. were landed in France; the loss by drainage amounting to 20 per cent. Means have been recently adopted in some colonial sugar-works for reducing this loss; but they may be better described after treating of the superior kind of raw sugar called *clayed sugar*.

Clayed sugar, which is also called *Lisbon sugar*, is raw sugar that has been subjected to an operation similar to that which has been described in the notice of East India sugar, as practised in the preparation of *chenee*. The sugar is removed from the coolers into conical earthen moulds called *formes*, each of which has a small hole at the apex. These holes being stopped up, the formes are placed, apex downwards, in other earthen vessels. The syrup, after being stirred round, is left for from fifteen to twenty hours to crystallize. The plugs are then withdrawn, to let out the uncrystallized syrup; and, the base of the crystallized loaf being removed, the forme is filled up with pulverised white sugar. This is well pressed down, and then a quantity of clay, mixed with water, is placed upon the sugar, the formes being put into fresh empty pots. The moisture from the clay, filtering through the sugar, carries with it a portion of the colouring-matter, which is more soluble than the crystals themselves. The clay may be repeatedly re-wetted or renewed, until, after about twenty days, the loaves are sufficiently purified to be removed from the formes. They are then dried gradually in a stove, and crushed into a coarse powder for exportation. The syrups that run off during the operation of claying contain much saccharine matter, and are therefore re-boiled, so as to form an inferior sugar. Claying is little practised in British plantations, from an opinion that the increase of labour and diminution of quantity of produce occasioned by it is not compensated by the improved quality of the sugar. It was however very generally practised by the French in St. Domingo, where four hundred plantations adopted the process.

A similar process to the above, so far as regards the result, is that patented by Mr. Hague, in 1816, for England, and in 1828 for the colonies. It consists in submitting the raw sugar, after being cured in the usual way, to the action of a vacuum filter. The apparatus consists of a shallow vessel, beneath which is a cavity or reservoir, connected with an air-pump. The bottom of the vessel is perforated with a number of small holes; and when a quantity of muscovado sugar, mixed with a little water into a pasty mass, is laid in it, upon a piece of haircloth, the air is withdrawn from the cavity beneath the sugar. The pressure of the superincumbent atmosphere upon the surface of the sugar then drives the moisture, and with it much of the colouring-matter, through the holes in the bottom of the vessel. When the sugar is sufficiently whitened, the air-pump is stopped, the sugar and molasses are removed, and a fresh charge of muscovado is applied. Mr. Porter states that this process has been applied with advantage in the colonies, and that it is likely to supersede claying. He considers that it may lead to economy not only by preventing the loss by drainage, but also by bringing the sugar to so dry a state that it might be packed in bags, like East India sugar, instead of casks. It is also important for effecting a saving of time in the preparation of sugar for shipment. Besides its use in the colonies in separating molasses from muscovado sugar, this plan has been applied to raw sugars in England, as the first step in the refining process.

Somewhat similar to the above is the plan patented by Mr. John Taylor for expelling molasses from raw sugar by the application of very powerful pressure; water or lime-water being previously mixed with the sugar in the proportion of one-eighth to one-tenth of its weight. This plan, according to Porter, is not equally efficient with that of Hague.

Another means of avoiding the loss consequent on the drainage from raw sugar during its voyage to this country, and that occasioned by the repeated solution of the sugar, which weakens its grain, is the importation of sugar for the use of the refiner, in the form of concentrated cane-juice, containing nearly half its weight of granular sugar along with more or less molasses, according to the care taken in the boiling operations. Dr. Ure appears very sanguine as to the result of this plan, observing, 'Were this means generally adopted, I am convinced that 30 per cent. would be added to the amount of home-made sugar-loaves corresponding to a given quantity of average cane-juice; while 30 per cent. would be taken from the amount of molasses.' The saving of labour in the colonies, by which the produce of the cane may be exported five or six weeks earlier than is usual, is also important. It had been feared that the syrup would undergo some chemical change during the voyage; but Dr. Ure states that among more than a hundred samples which he had analysed for the Custom-house, he had not perceived any traces of fermentation. He adds, however, that it does not appear that our sugar colonists have availed themselves of the proper chemical method of counteracting that incipient fermentation of the cane-juice which sometimes supervenes, and proves so injurious to its products. A very slight *muting*, or impregnation with sulphurous acid, such as might be given by burning a sulphur match in the cistern immediately before charging it from the mill, would, he says, suffice for the most fermentable cane-juice; and the sulphurous acid might be driven off by heating the cane-juice in the clarifier before adding the temper-lime, so as to prevent the introduction of calcareous sulphite into the sugar. A like process is adopted successfully with grape-must.

Sugar-refining.—Raw or muscovado sugar, as brought from the colonies, forms the common moist or brown sugar of the shops. The saccharine particles are always mixed with other matter, which imparts to the sugar a dark colour, a moist clammy feeling, and an empyreumatic odour. The impure matter is stated by Dr. Ure to consist of gluten, lime, and particularly caramel. The object of the sugar-refiner is to remove these impurities, so as to obtain the sugar in the hard white semi-transparent state known as *loaf sugar*.

The art of refining sugar, as well as that of extracting it from the cane, is supposed to have been brought to Europe from the East, probably from China; but at what time is uncertain. The Venetians are believed to have been the earliest sugar-refiners in Europe; and it is known that they practised the art before the discovery of America. Macpherson (*Annals of Commerce*, vol. ii., p. 25, note) says that it appears, from the accounts of the chamberlain of Scotland, published from the originals in the Exchequer, by John Davidson, Esq., that in 1329 *loaves of sugar* were sold in Scotland at the price of 1*s.* 9½*d.* (more than an ounce of standard silver) per lb.* Heylyn, in his 'Cosmographie' (in the account of the island of St. Thomas), speaks of the art of refining as 'first found out by a Venetian in the days of our forefathers, who got 100,000 crowns by the invention;' but this often-repeated statement gives little information, and cannot be received as conclusive as to the invention. It appears however that the Venetians originally operated upon the coarse black sugar brought from Egypt, and that they followed the Chinese practice of converting it into sugar-candy before they made loaf-sugar. Stow's 'Survey of London' states that sugar-refining was commenced in England about 1544. There were then two sugar-houses in London, but they yielded little profit, because there were many sugar-bakers in Antwerp who could supply refined sugar to England better and cheaper than it could be made at home. Subsequently, the commerce between England and Antwerp being stopped, those two sugar-houses supplied all England for twenty years, and became so profitable, that many other persons embarked in the business. Moseley says that in 1596 Sir Thomas Mildmay, on the pretext that frauds were practised in refining sugar, petitioned Queen Elizabeth for a licence for an exclusive right to refine sugars for a term of years; for which monopoly he offered to pay an annual sum. His petition was rejected, 'and,' Moseley adds, 'England, which formerly had been supplied with refined sugar from Antwerp, the [illegible] commercial city then in Europe, now not only supplied itself, but exported great quantities to other countries.' Anderson was therefore mistaken in supposing that the first account of sugar-refining in England was that in a pamphlet printed in 1659, which he quotes under that year for a notice of the prosperity of Barbadoes.

Few manufacturing operations have undergone of late years more important changes than that of sugar-refining. As generally practised until recently, the process commenced by mixing the raw sugar in a large open copper with lime-water, and adding to the mixture when warm a quantity of bullock's blood. The heat occasioned the serum of the blood, which consists chiefly of albumen, to coagulate, and in so doing to collect most of the impurities floating in the liquor, and to raise them with it to the surface of the syrup in the form of a thick scum, which was carefully removed. This clarifying process was sometimes repeated with a fresh quantity of blood, or, as it is technically called, *spice*. When the liquor was thus rendered tolerably clear, and was partially evaporated by boiling, it was further cleansed by passing it through a filter of thick woollen cloth, which detained any particles of scum that might have been left after skimming the liquor. It was afterwards concentrated by boiling in a smaller open copper till it was sufficiently thick for graining; after which it was formed into loaves in the manner hereafter described. For loaves of the finest quality a second refining followed this; the loaves produced by the first operation being broken and re-dissolved, either in water or lime-water, and then again clarified with white of egg beaten up with sugar and water: this, being almost pure albumen, acted in a similar way to the serum of the blood, and threw up a greyish scum. A small quantity of indigo, finely powdered and mixed with syrup, was then added; the effect of which was to throw up a slight scum, and by its colour to neutralize the yellow colour of the liquor. The same processes of filtering, concentrating, and pouring the syrup into moulds, follow in this as in the case of single-refined sugar.

In the preceding section allusion has been made to the methods of separating molasses from raw sugar by the vacuum-filter and the hydraulic-press, both of which have been applied to the preparation of sugar for refining. Aikin states that by the latter process sugar is now capable of yielding loaves equal to double-refined by one process.

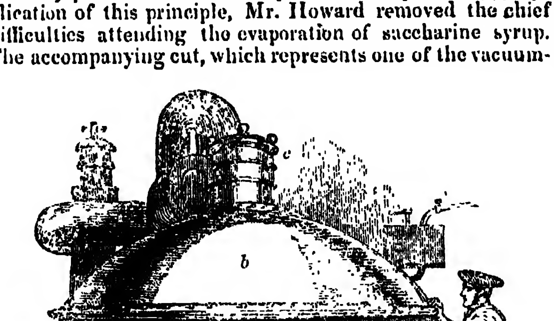
Many improvements have been effected upon the old methods of clarifying and concentrating the syrup. Several of these improvements are fully detailed by Mr. Porter, to whose work we refer for further information. The reader may also consult No. 582 of the 'Penny Magazine,' which contains an account (illustrated by cuts of some of the apparatus employed) of a visit to the refinery of Messrs. Fairrie, at Whitechapel. In the process there described the raw sugar is transferred from the casks into large circular vessels, called *blow-up cisterns*, in which it is mixed with water, and with a small quantity of lime dissolved in water so as to form a milky fluid. The mass is heated by steam, which is forced by its own pressure through small apertures in copper pipes, which are laid along the bottom and sides of the vessel: and the perfect solution of the sugar is aided by stirring with long poles or oars. The liquor is not in this case skimmed, but is allowed to flow from the blow-up cistern to a range of filtering-vessels in a room beneath. The filters are tall vessels six or eight feet high, of cast-iron or wood, having cisterns at top and bottom, and a number of cloth or canvas tubes, closed at their lower ends, but communicating at their upper ends, by which they are suspended, with the upper cistern. Within each of these tubes is a bag of thick close cotton-cloth, which, being much larger in diameter than the tube in which it is enclosed, is necessarily folded together. At the establishment alluded to, sixty such compound bags or tubes are comprised in each filter; the inner bags being six feet long and two wide, while the outer tubes are only about three inches in diameter. By this device a very extensive filtering surface is obtained in a small compass; and, as the liquor from the upper cistern cannot escape from the bags excepting by percolating through the meshes of the cloth, it becomes, as it drops into the lower cistern, very clear and transparent; most of the solid impurities remaining in the bags. When the bags and tubes are clogged up, they are removed from the filter and washed; but as the solid particles removed from them contain some saccharine matter, they are subjected to a subsequent process for its extraction, and the refuse of this process is sold for manure. On leaving the filter, the syrup, though clear and transparent, is of a reddish colour; and the removal of this tinge is effected by filtering the syrup through a mass of powdered charcoal. The application of the bleaching power of charcoal to the purification of sugar is one of the great improvements effected by modern science. Animal charcoal, or burnt bone, is found very superior to the charcoal of wood, for this purpose; possibly because, from the quantity of earthy matter which exists in bone, the carbonaceous particles are more finely divided than those of vegetable charcoal. Animal charcoal is variously applied in the bleaching of sugar-syrup; but in the case immediately under notice it is used in the form of a coarse powder resembling gunpowder in grain. It is placed in a large square vessel, which has a perforated false bottom covered with a piece of cloth, upon which the charcoal is laid to the thickness of nearly three feet. The syrup is conducted by pipes from the bag-filter to the surface of the charcoal, through which it percolates slowly; it then drops through the cloth, and through the holes in the perforated bottom, into the cavity beneath, where it is found almost colourless. The pulverised charcoal, after becoming foul by use, is first washed by passing water through it until all the soluble matter is removed, and then re-calcined in a retort-house on the premises; whereby all the remaining impurities are driven off, and the valuable properties of the charcoal, or *bone-black*, are restored, so that it may be used again and again.

In some cases, before the sugar is placed in the blowing-up cistern, it is partially purified by mixing it into a pap with hot water or steam, and exposing it to drain in large sugar-moulds, similar to those used in the preparation of

* The value of money in Scotland at the time alluded to may be seen by other items of the same account, which are given in the Appendix, No. iii., to Macpherson's fourth volume. From these it appears that the price of a horse varied from 5*s.* to 13*s.* 4*d.*; that an ox cost 10*s.*; and a sheep from 1*s.* 2*d.* to 2*s.*

clayed sugar. In this case the purification may be rendered more complete by the filtration of moisture from a magma of sugar (a mass of wet sugar in a state resembling mortar), applied in the same way as that of clay in the claying process. Sometimes also a little blood is mixed with the sugar in the blow-up cistern; or, instead of it, a mixture of gelatinous alumina and gypsum, called *finings*, prepared by adding a solution of alum to a body of lime-water, and collecting, washing, and draining the precipitate upon a filter, is used. Other refiners use both the blood and finings. The bone-black, in the state of very fine powder, is also, by some refiners, mixed with the sugar in the blowing-up cistern, in the proportion of from 5 to 20 per cent. of the whole, instead of being used in the manner first described. Dr. Ure, who mentions this order of procedure, states that the liquor which first passes through the bag-filter is generally tinged a little with the bone-black, and must therefore be pumped back into the upper cistern for refiltration. He adds that, in cold weather, the case containing the bag-filters may be kept warm by steam-pipes. Aikin observes that, from experiments on the mode of action of animal charcoal in the manufacture of beet-sugar, it appears not only to attract to itself the colouring-matter, and to destroy the peculiar flavour by which one kind of sugar is distinguished from another; but also to have the property of removing much of the mucilage, and thus facilitating the crystallization of the pure saccharine part. He states also that it has been used with great advantage in clarifying the cane-juice itself, and thus obtaining a raw sugar nearly equal to brown sugar-candy.

In the evaporation or concentration of the clarified syrup, which forms the next part of the refining process, improvements of the greatest importance have been effected. In the old plan of concentrating the syrup in open pans, they were heated by fires to a temperature of from 230° to 250° Fahr. Many plans were contrived for rendering the application of heat more regular and controllable, by the intervention, between the fire and the evaporating pans, of fluids which, under the ordinary atmospheric pressure, cannot be raised above the proper temperature; by heating the pans by means of steam-pipes; or by some similar contrivance. The most valuable invention of all appears to be that patented in 1813 by the Honourable Edward Charles Howard, and now extensively used under the name of Howard's vacuum-pan. It is well known that fluids will boil at a much lower temperature in a partial vacuum than when exposed to the ordinary pressure of the atmosphere; and by the happy application of this principle, Mr. Howard removed the chief difficulties attending the evaporation of saccharine syrup. The accompanying cut, which represents one of the vacuum-



pans used at the refinery of Messrs. Fairrie, may assist in the explanation of this admirable contrivance. The apparatus consists of a close copper vessel, *a*, *b*, the several parts of which are united by flanges, with packing between the joints to render them perfectly air-tight. The middle portion of this vessel, *a*, is cylindrical, and from six to seven feet in diameter, and the upper part, *b*, is convex or dome-shaped. The bottom of the pan is also convex, but in a less degree, being part of a larger sphere. The whole is supported upon legs, so that every part may be readily inspected. The bottom of the pan is double, the cavity between the inner and outer bottom forming a receptacle for steam, the admission of which raises the contents of the pan to any required temperature. The best kind of pans have also a spiral coil of copper pipe a little above the inner bottom, about on a level with the lower flange, or bottom of the cylindrical part of the vessel, by which steam may be made to circulate through the body of syrup in the pan, and thereby to greatly assist in its evaporation. The bottom cavity is supplied with steam generated at a low pressure; but the spiral pipe contains steam of high pressure, and consequently of great heat. *c* is a small cavity called the *neck*, rising from the centre of the dome, from which, by means of the bent tube and apparatus seen behind the pan, a communication is formed with an air-pump, by which the pan may be partially exhausted of air. A communication is also formed between the interior of the pan and a vessel containing clarified syrup; and another, by means of a pipe from the bottom of the pan, with a vessel in the room below, which receives the sugar after it has been boiled; each of these communications, as well as that with the air-pump, being supplied with valves, by which they may be opened or closed at pleasure. The pan is supplied with apparatus by which the temperature of the syrup, the rarity of the air, &c., can be readily ascertained; and it has a safety-valve to admit air in case of the air-pump acting too fast; so that the vacuum cannot be accidentally made too perfect, by which the pressure of the external atmosphere might become dangerous. The subsidiary parts of the apparatus may be variously arranged, but do not require further description. In using the pan, a quantity of liquid sugar is admitted, sometimes from a vessel placed above it, and sometimes from one on a lower level: in the latter case, the syrup is forced into the pan by the pressure of the atmosphere, on the same principle that water rises in a common pump—a partial vacuum being formed in the pan by the action of the air-pump. The air-pump continues at work during the boiling or evaporation of the syrup, motion being communicated to it from a steam-engine; and by this means the sugar is enabled to boil at a temperature of only 130° to 150°, or 100° lower than that required in open vessels. To enable the person who superintends the process to ascertain when the syrup is sufficiently evaporated, the pan is supplied with a very ingenious appendage called the *proof-stick*, the handle of which is shown at *d*. This contrivance consists of a tube extending into the body of sugar in the pan, and terminating in a peculiar kind of valve, so formed that, by turning a rod which is inserted in the tube, a sample of sugar may be taken and drawn out with the rod, without admitting air into the vessel. The sample thus obtained is examined and tried by the *touch*, as described in explaining the process of evaporation in the West Indies; and when it appears to be in a satisfactory state, the sugar is allowed to flow, through an opening in the bottom of the pan, into a granulating-vessel in a room below.

The important improvement of boiling sugar in vacuo made way, for a considerable time, but slowly. At length however the superiority of the new process became so apparent, that it was extensively adopted. It is stated in the 'Penny Magazine' that, in some years, the premiums paid by refiners for permission to use the patent process amounted, collectively, to more than forty thousand pounds.

The practice of boiling the syrup at so low a temperature has occasioned a curious difference in the next process, which is that of granulating or crystallizing the concentrated liquor. In the West Indies, the vessels used for this purpose are called *coolers*, because in them the syrup is brought down to a much lower temperature than it has received in the boiling-coppers. The corresponding vessels used in refining sugar upon the old plan were similar to these, and were called by the same name; but when the method of boiling at a low temperature is adopted, the granulators become *heaters* instead of *coolers*; the sugar, when placed in them, being raised to a temperature of 180° or 190°. This is done by the admission of steam into a cavity surrounding the granulating-vessel, which is a shallow open copper or pan, in which the thick pulpy mass is stirred violently to promote the granulation.*

* Aikin observes, respecting this process, 'If the syrup, whether for single or double refined sugar, after being properly boiled, were poured directly into the earthen cones, instead of being previously well beaten while in the cooler, the crystallization, which is purposely disturbed by the beating, would take place regularly, and the result would be a mass of crystals; but sugar, in so crystallizing, does not exclude the whole of the colouring-matter, nor could the process of claying be employed, under such circumstances, with any good effect.'

It should be borne in mind that, owing to the low temperature of the sugar in the vacuum-pan, it is, in a great measure, crystallized before leaving it; so that the principal object of the subsequent reheating in the granulator is to bring it into a favourable state for removal to the moulds. To promote the formation of large crystals in the pan, it has been thought advisable to admit the charge of syrup in several successive portions, that the crystals of the first may form nuclei to those of the subsequently added portions; but Dr. Ure conceives that this hypothesis is more specious than sound, because the subsequent heat applied in the granulator reduces the crystals again to a small size.

From the granulators the sugar is transferred, by means of copper basins or pans, into moulds of a conical form, which were formerly made of coarse pottery, but are now usually of iron. These moulds, like those used in the claying process, have orifices at their points, which are stopped up before they are filled with sugar. They are arranged on the floor in rows, with their open bases uppermost; and immediately after the sugar is poured in it is stirred round, to diffuse the crystals equally through the semifluid mass. They are then left for several hours, that the sugar may become solid: after which they are removed to another room; and, their points being unstopped, and the concreted sugar at the apex being pierced by a steel wire, they are set in earthen jars, that the uncrystallized fluid may drain from them; or the same purpose is effected by placing them in racks, with gutters to receive and conduct to a cistern the syrup that flows from the sugar. This syrup is re-boiled with raw sugar, so as to yield an inferior quality of sugar; and when all the crystallizable matter has been extracted from it, the remainder is sold as treacle. It was formerly usual to 'clay' the loaves in order more thoroughly to remove the molasses; but this process is abandoned by most refiners for the superior method introduced by Mr. Howard of cleansing the loaf by causing a saturated solution of sugar in water to percolate through it. When the loaf of sugar is thoroughly purified by the repetition of this process, and is sufficiently dry, it is turned out of the mould; the base being scraped to an even surface, and the apex applied to a kind of lathe, in which any part that may be slightly discoloured is cut off, leaving the end clean and smooth. The coarser loaves, instead of being turned, merely have their damp ends chopped off, so as to reduce them to the form of truncated cones. The loaves are finally dried in an oven heated by steam-pipes to a temperature of 130° or 140°, and then wrapped up in paper for sale.

It is needless to follow the processes by which the syrups and other refuse of the best sugar are converted into sugars of inferior quality, which are either sold as cheap loaf-sugar, or formed into large coarse loaves called *bastards*, which are crushed into powder for sale; or to detail further the results of the improved processes introduced of late years. It has been asserted that about two-thirds of the molasses found in the moulds under the old system were formed by the intense heat employed in concentrating the syrup; a loss which is now, in a great measure, obviated. The discontinuance of the use of fires to heat the vessels employed is attended with great advantage on the score of safety as well as convenience; heat being conveyed to every part of the building, in any required quantity, by means of steam-pipes. The effect of these improvements in diminishing the price, and consequently increasing the consumption of refined sugar, is also very important; the cost of refined sugar being now only about 20 per cent. greater than that of raw sugar, although formerly the difference of price was as much as 40 per cent.

Sugar-Candy.—This is the only kind of refined sugar made in China and India; and is made of the finest quality by the Chinese, who export it in considerable quantities. M'Culloch states that two sorts are met with at Canton, called, respectively, Chinchew and Canton; the former being the produce of the province of Fokien, and the latter of that of Canton. Of these, the former is by far the best. He adds that Chinese sugar-candy is consumed, to the almost total exclusion of other sugar, by the Europeans at the settlements in the East.

Candy is sugar which, after being more or less perfectly refined, is suffered to crystallize very slowly upon strings or twigs. For making it, the syrup is poured into moulds in a much thinner state than for loaf-sugar, in order that the viscidity of the fluid may not impede the aggregation of the saccharine particles around the threads or twigs inserted for the purpose; and, to maintain the necessary degree of fluidity, the moulds or boxes are placed in a stove, and kept hot for several days. Perfect stillness is important during this operation, as any disturbance reduces the size of the crystals. The syrup is afterwards let off very gradually. The crystals vary much in shape, and become grouped or agglomerated together as they form upon the strings or the sides of the box or mould. Candy is more transparent and harder than loaf-sugar; and its hardness renders it less soluble. Aikin observes that it is, on this account, often represented as less sweet than loaf-sugar, for the same reason that the latter is popularly considered less sweet than muscovado sugar; but that there appears no reason for supposing that sweetness is not the essential character of sugar, and therefore that the purer it is, the more perfectly is its sweetness brought out. Coloured sugar-candy is made by mixing cochineal, indigo, or other colouring-matter with the syrup; and perfumed candy may be impregnated with any desired scent in the same way.

Beet-root Sugar.—The process of manufacturing sugar from beet has been fully detailed in a previous volume [Beet, vol. iv., p. 160]; and is also noticed in pages 231 and 235 of the present volume. Beet-root sugar is now extensively manufactured in many parts of the continent of Europe; but its success is probably owing, in a great measure, if not entirely, to the heavy imposts upon colonial sugar.

The manufacture of beet-root sugar in the United Kingdom is regulated by an act passed in 1837 (1 Vict., c. 57), and it is subject to the same duty as British plantation sugar: none however is made. In Russia the cultivation of beet-root for sugar was for some time carried on very actively; but the profits not being so great as were expected, the manufacture is declining. In 1841 the number of beet-root refineries in Russia was 174, and the total produce was 2009 tons, the importation of colonial sugar being 26,932 tons. In Saxony the manufacture has proved a failure, and there are now only two establishments. In Hanover it is of very little importance; and there are only two manufactories, at Nienburg and near Osnabrück. The commercial treaty with Holland, under which colonial sugar is admitted at a moderate duty, has had the effect of checking the operation of the beet-root sugar manufactories in Prussia. The quantity manufactured in 1840, in fifty beet-root establishments in the province of Magdeburg, was 1,600,000 cwt., and the capital embarked in buildings and machinery is said to exceed 1,000,000*l*. sterling, some of the establishments having cost 30,000*l*. The manufacturers hope that the duty on colonial sugar will be increased to 30*s*. per cwt. The manufacture of beet-root sugar is more extensive in France than in any part of the Continent. In 1841 the number of acres cultivated with beet-root for sugar was 142,518; and in the same year the quantity of sugar produced was 31,621,923 cwt., of which one-third was manufactured in the north-eastern departments. The number of manufactories was 389, some of them provided with very costly machinery made in England. In the session of 1842 the French government proposed to reduce the duty on colonial sugar, but the interests of the beet-root sugar manufacturers were sufficiently powerful to procure an adjournment of the question for a year, and it is probable that they will demand compensation if the proposed alteration be effected.

Maple Sugar.—The earliest notice we have met with of sugar made from the juice of the sugar-maple [Acer, vol. i., p. 79] is a paper in No. 364 of the 'Philosophical Transactions,' which was published in 1720, entitled 'An Account of the Method of making Sugar from the Juice of the Maple-Tree in New England,' by Paul Dudley. This proves that Macpherson was in error when he stated (*Annals of Commerce*, vol. iv., p. 209) that the manufacture was first attempted about 1752; although for some time after that date it was carried on in a very limited way. He informs us that the difficulty of procuring supplies of West India sugar during the American revolutionary war contributed to give it more importance; and the convenient circumstance that the principal time for making the sugar, about February and March, is that at which, owing to the frost, there is a scarcity of other employment, induced many of the farmers of Canada and Nova Scotia to prepare maple-sugar, not only for their own use, but also for sale at Quebec, Halifax, and other places. About 1790 this branch of husbandry was much attended to in the middle states of North America, and refined maple sugar was sold in Philadelphia,

which was pronounced equal to any loaf-sugar made from West Indian muscovado sugar. Maple-sugar is still made for domestic use in many parts of the United States.

The sap is obtained by boring holes in the trunk, in a direction inclining upwards, with an auger about three-quarters of an inch in diameter; the depth of the holes being such that they may penetrate about half an inch into the alburnum, or white bark, as the sap is found to flow more freely at that depth than at any other. The south side of the trunk is considered best for boring the holes, of which two or three, at a height of eighteen or twenty inches from the ground, are said to be sufficient for an ordinary tree. Tubes of elder or sumach are inserted in the holes, so as to project a few inches from the trunk; their outer ends being cut so as to form small troughs, along which the sap trickles into receptacles placed beneath them. The season for collecting the sap extends for about six weeks, ranging between the beginning of February and the middle of April. This is done in frosty weather; yet the tendency of the juice to fermentation renders it desirable to boil down the sap at furthest within two or three days from the time of its extraction. This is done in very rude apparatus, which is carried to the encampment formed by the sugar-makers. The syrup is thus brought to about one-third of its original bulk, the scum which rises being removed. White of egg is sometimes used as a clarifier; and occasionally a little butter or fat is thrown in during the last boiling. The molasses are separated, though mostly in a very imperfect manner, by filtration. The concreted sugar is said to be equal in taste to cane-sugar, and to sweeten as well; and when the molasses are well removed, the sugar is not deliquescent, like equally brown sugar from the cane. It is seldom refined, but is capable of being made equal to loaf-sugar from the cane. The composition of maple-sugar is noticed in the next article.

(Moseley's *Treatise on Sugar*, second edit., 1800; Porter on *The Nature and Properties of the Sugar-Cane*, &c., 1830; Edwards's *History of the West Indies*; Anderson's *History of Commerce*, second edit., 1787-9; Macpherson's *Annals of Commerce*; Ure's *Dictionary of Arts*, &c.; M'Culloch's *Dictionary of Commerce*; *Transactions of the Society of Arts*, vol. li., pp. 143-188; *Memoirs of the Literary and Philosophical Society of Manchester*, vol. iv., p. 291, &c.)

SUGAR. (Chemistry.) The following are the general properties of sugar obtained from different sources:—

Cane Sugar.—The properties of this are, that it is colourless, inodorous, of a purely sweet taste, moderately hard, and brittle. The crystals, when rapidly formed, as in common refined sugar, are small; but when obtained by the slow evaporation of a strong solution, they are of considerable size and prismatic in their form (sugar-candy). The specific gravity of sugar is about 1·065: it undergoes no change by exposure to the air; and, when moderately heated, loses only a little hygrometric moisture: it is soluble in one-third of its weight of cold water, and combines with hot water in all proportions: a solution saturated at 230° forms, on cooling, a mass of small crystals. It is soluble in alcohol, but much less so than in water; for absolute alcohol takes up only 1-80th of its weight, even when boiling, and this separates in small crystals as the solution cools: spirit of wine, of specific gravity 0·830, dissolves nearly one-fourth of its weight. Sugar is phosphorescent when two pieces are rubbed together in the dark. When heated to 365° sugar melts into a viscid colourless liquid, which, when cooled suddenly, becomes a transparent mass (barley-sugar): by keeping, it becomes opaque; at 400° to 420° sugar is converted into caramel by losing an equivalent of water. When exposed to a high temperature, sugar undergoes decomposition, yielding various gaseous products, and leaving a large proportion of charcoal. The acids produce very different effects upon sugar: thus nitric acid decomposes and is decomposed by it, the principal products being nitric oxide, carbonic, oxalic, and saccharic acids: by sulphuric acid, when concentrated, sugar, or even a strong solution of it, is readily decomposed, sulphurous and carbonic acid gases being formed and evolved, and a large quantity of charcoal remains: 1-100th of a grain of sugar, on account of the large proportion of charcoal which it contains, is capable of imparting colour to an ounce of sulphuric acid. When however sugar dissolved in dilute sulphuric acid is kept for a long time at a high temperature, it absorbs oxygen from the air, formic acid is produced, and there is deposited a brown insoluble matter, which has been supposed to be identical with humus or humic acid. Hydrochloric acid dissolves sugar, and forms with it a thick black resinous paste. Although even a solution of sugar undergoes change slowly when exposed to the air, yet by the addition of yest it undergoes fermentation, and is converted by it, as is supposed, first into grape sugar, and then, as is well known, into alcohol.

Sugar in many cases combines with the alkalis, earths, and metallic oxides, and, in some cases, forms definite compounds with them: with ammonia, according to Berzelius, sugar combines to form a compound of one equivalent of each; but by exposure to the air the ammonia escapes, and leaves the sugar unaltered: potash and soda appear also to combine with sugar, and they destroy its sweetness; this is restored when the alkalis are saturated with an acid: but if they be left long in contact, the sugar becomes changed into a substance resembling gum.

Lime, barytes, and oxide of lead dissolve in considerable quantity in a solution of sugar: when the first-mentioned of these bodies, in the state of hydrate, is digested at a moderate heat in a solution of sugar, a bitter alkaline solution is obtained, in which the sugar is combined with more than half its weight of lime: Professor Daniell obtained, by the action of these bodies, gum and crystals of carbonate of lime. According to Peligot, the compound of sugar and lime consists of one equivalent each of caramel or anhydrous sugar, lime, and water. The compound of sugar and barytes is similar. When hydrated oxide of lead is digested in a solution of sugar, a yellow alkaline liquid is formed, which yields a tough deliquescent mass by evaporation; but when excess of the oxide is boiled in a solution of sugar, and the liquor is filtered hot, it deposits eventually bulky flakes of a tasteless insoluble compound, composed of, according to Berzelius, one equivalent of sugar and two equivalents of oxide of lead, or 42·35 sugar + 57·65 oxide.

Sugar dissolves carbonate and diacetate of copper, forming green solutions which are not decomposed by the alkalis, and this is also the case with the salts of iron. A crystalline compound of sugar and common salt may be formed by the spontaneous evaporation of a solution of four parts of the former and one part of the latter.

According to the analysis of Berzelius, cane sugar consists of—

Twelve equivalents of carbon	.	72	or	6·1
Eleven equivalents of hydrogen	.	11	..	42·1
Eleven equivalents of oxygen	.	88	..	51·5
Equivalent	.	171		100·

When exposed to a high temperature, as already noticed, two equivalents each of oxygen and hydrogen are separated: the equivalent of the remaining caramel or anhydrous sugar is of course = 153.

The uses of cane sugar are too well known to require much notice: on account of its antiseptic power, it is employed to preserve various vegetable products: it is used as a sweetener of many kinds of food, and is in these cases nutritious; but being destitute of azote, like other substances similarly constituted, it is incapable of supporting life for any length of time.

Maple Sugar, when refined, is stated to be equal in appearance and sweetening power to refined cane sugar; and in composition they are very similar. According to Dr. Prout's analysis, maple sugar may be considered as composed of—

Twelve equivalents of carbon	.	72	or	42·1
Eleven equivalents of hydrogen	.	10	..	6·4
Eleven equivalents of oxygen	.	88	..	51·5
Equivalent	.	171		100·

Beet-root Sugar, according to the analysis of Dr. Prout, is exactly similar to that of cane and maple sugar.

Grape Sugar.—Water dissolves less of this than of cane sugar, the solution is less viscid, and it is not so sweet; alcohol however dissolves more of it, but it is deposited from it in crystalline grains. With sulphuric acid, instead of being charred, as cane sugar is, it forms a compound acid called *sulphosaccharic acid*, which gives no precipitate with the salts of barytes.

According to Saussure, this sugar is composed of—

Twelve equivalents of carbon	.	72	or	36·36
Fourteen equivalents of hydrogen	.	14	..	7·07
Fourteen equivalents of oxygen	.	112	..	56·57
Equivalent	.	198		100·

Manna Sugar.—*Mannite* is contained in manna which exudes from the *Fraxinus Ornus* and other species of ash: the best is imported from Sicily and Calabria, under the name of *flake manna:* from this the sugar is procured by boiling it in alcohol, and as the solution cools the mannite crystallizes: by very slow crystallization it may be obtained colourless, in slender four-sided prisms of a silky lustre. It has a slightly sweet taste, is very soluble in water, but the solution is not fermentable. Mannite is also produced during the fermentation of cane and grape sugar. It appears to be composed of—

Six equivalents of carbon	36	or	39·6
Seven equivalents of hydrogen	7	..	7·6
Six equivalents of oxygen	48	..	52·8
Equivalent	91		100·

It may be observed, that, unlike any of the preceding varieties of sugar, the oxygen and hydrogen do not exist in this kind in the proportions which form water.

Honey Sugar contains two kinds of sugar, one resembles grape sugar, and the other is uncrystallizable: the solid sugar is obtained from granular honey by the action of strong alcohol; this leaves the sugar, but dissolves the other ingredients: by dissolving in water, treatment with animal charcoal, and evaporation, this sugar may be obtained in a white granular state.

Liquorice Sugar, or *Glycyrrhizin*, is obtained from liquorice-root: it is a yellow transparent substance, extremely sweet, very soluble both in water and alcohol, and has a great tendency to combine with acids, bases, and salts: it occasions precipitates in the solutions of most metallic salts.

Mushroom Sugar is obtained from several species of agaricus, &c. It crystallizes in square prisms, is colourless, only slightly sweet, and less soluble in water than cane sugar. It forms a red solution in concentrated sulphuric acid.

The sugar of malted grain, and that formed artificially from starch, have the general characters of grape sugar.

Sugar of Milk, or *Lactine*, is obtained by evaporating the whey of milk to its crystallizing point: it forms colourless four-sided prisms, which are soluble in about six parts of cold water and two and a half parts of hot: the taste of this sugar is not very sweet, it is unalterable in the air, and is insoluble in alcohol and æther.

According to the experiments of Berzelius, when anhydrous it is composed of nearly—

Two equivalents of carbon	30	or	45·45
Four equivalents of hydrogen	4	..	6·06
Four equivalents of oxygen	32	..	48·49
Equivalent	66		100·

In its crystallized state it contains one equivalent of water = 9.

Sugar of Diabetic Urine has the general characters of grape sugar. [Diabetes.]

SUGAR, Properties of. Sugar is a proximate principle, chiefly of vegetables, but also sparingly of animals of the class Mammalia. It presents considerable varieties, according to the source whence it is obtained, and is distinguished into those which are capable of undergoing the vinous fermentation, and into those which are not; also into those which can assume a definite crystalline form, and those which cannot; but sometimes these two kinds co-exist in the same sort, as in the sugar from the sugar-cane, which yields both the finest crystals and likewise molasses or treacle. It almost invariably exists in a dilute and liquid state in plants, but it occasionally exhibits a crystalline form in the flower of certain plants, such as the Rhododendron ponticum, the Strelitzia Reginae, and Eucomis punctata. Sugar is the great principle by which rapidly-growing succulent parts of plants and seeds, when they germinate, are nourished. Hence it is produced in large quantities in such seeds as contain starch, when excited to germinate, as may be observed in the process of malting, which up to a certain stage is exactly that of the germination of the seed. Under these circumstances, seeds which are insipid from the bland nature of the starch which they contain become sweet. By this means many seeds which are regarded as little suited for the nourishment of man may be made to contribute to his support, by merely steeping them in water till they sprout, as is practised by the Burmese with the seed of the cotton-plant. (Malcolm's *Travels in Burmah.*)

A similar transformation of starch into sugar takes place in the ripening of many fruits. Thus the fruit of the banana, or plaintain, which, when gathered green, abounds in starch, if allowed to ripen on the stalk is destitute of starch, and yields much gummy and saccharine matters. The same happens when the palms are about to flower, as all the starch in their lofty stems is rapidly transformed into sugar; and hence the sago-palm (Sagus Rumphii, &c.) and the Mauritia flexuosa (sago-palm of the Orinoco) are cut down just when the flower-buds begin to appear, to obtain the sago they contain. In other palms the flower-buds are allowed to protrude, and a wound being made in the spatha, a large quantity of a sweet fluid distils, which may either be concentrated by boiling, when sugar is deposited, or the liquid may be fermented, and so yield the *toddy* called *palm wine*. If these, or the sugar-cane, maize, or our common esculent roots, parsnep, skirret, carrot, or beet, are allowed to flower, all the gummy and saccharine matters disappear from the roots or stem. The transformation of starch into gum and sugar is effected by a principle called *diastase*, which is so powerful, that 'one part of it is sufficient to render soluble the interior portion of two thousand parts of starch, and convert it into sugar.' Wherever buds are lodged, there the elements of diastase are placed, to come into play, when they begin to sprout, and supply them with food in a state of solution, as is the case with the buds or eyes of potatoes.

Many seeds, before they are ripe, contain a saccharine substance, which is changed into starch when fully ripe, but which again becomes sugar in germinating, such as the garden pea. Many stems of grasses are sweet at an early stage of their growth, but become insipid at a later period. This influences greatly the nutritive powers of these grasses, according to the stage of growth when they are cut down and made into hay. (See Appendix to Davy's *Agricultural Chemistry.*) Those which have been allowed to become too ripe are often restored to a proper state by the fermentation (*heating*) which occurs after the hay is stacked; but this is sometimes so violent as to consume the rick. It is an error committed in the agriculture of Scotland that the grass is generally allowed to become too ripe before it is mown; and hence English horses manifest an aversion to the hay of Scotland when first offered to them.

These facts explain why it is necessary to pluck up the beet-root which is grown in the south of France much earlier than that raised in the north; and also why the quantity and quality of the juice of the sugar-cane varies in different seasons. 'The juice of the sugar-cane varies in its constituent parts according to the nature of the soil, the quantity of rain, the distribution of heat in the different seasons, and the disposition more or less precocious of the plant when in flower.' (Humboldt, *Pers. Narrative*, vii., p. 184.) The soil affects it much, as the canes grown on the sea-coast, if watered with salt-water, yield a juice which is brackish: this is thought however to be better fitted for distillation of spirit than that produced from the canes of the interior. (*Ibid.*, iii., p. 210.) Even the highly manuring of beet-root lessens the quantity of sugar.

The starch lodged in the stem of certain trees in autumn is converted, by the ascending sap in spring, into sugar, with great rapidity. This is the case with the Acer saccharinum, or sugar-maple, and many other species of that genus.

The same is the case with the ascending sap of the birch-tree, but this does not contain sufficient sugar to permit the concentration of it; there is enough however to undergo the vinous fermentation, and thereby furnish the agreeable beverage called *birch wine*.

Next to the sugars from the cane and beet-root, among those which are crystallizable and capable of fermentation, the most important is the *granular* sugar obtained from a great variety of sources. It exists in considerable quantity in the juice of grapes, and hence the name *grape sugar*, which should be limited to this particular variety, is sometimes extended to the whole class of krummel sugars. It forms a constituent of a great many fruits, not merely fleshy, such as pears, cherries, peaches, melons, dates, figs, grapes, on which last two it forms a white incrustation when these are dried, but in chesnuts, when produced in warm regions. It exists in the nectaries of many flowers, and is collected by the bees; hence honey is only one of the kinds of this sugar. Though harmless in probably all instances to the bees, from whatever plant collected, it not unfrequently

has a poisonous influence over human beings, when it has been collected from poisonous plants, such as Rhododendrons and their allied genera.*

Granular sugar is readily formed by the action of dilute sulphuric acid on starch, or sugar of milk, or the *bastard* sugar which remains after the finest refined sugar has been procured from the cane or beet-root sugar. Lignin, or anything containing or formed from it, such as saw-dust, linen-rags, or paper, may be likewise transformed into granular sugar. It is likewise the kind of sugar formed during the germination of seeds. Lastly, it is that kind of sugar which is formed by a perverted action of the digestive and assimilating organs in the disease termed *diabetes mellitus*. [Diabetes.] All these varieties taste less sweet than the cane-sugar, and also differ among themselves; thus grape and honey sugar are sweeter than that from starch, while starch sugar is sweeter than that obtained from juniper berries. All of them contain less carbon and more water than the cane sugar, and may be regarded as hydrates of sugar.

Sugar, which, though with difficulty crystallized, is referred to this section, exists in many fungi or mushrooms, especially of the genus Agaricus. While it contributes to their nutritive properties, it most likely proves one source of the poisonous qualities they sometimes possess, as it is occasionally transformed into oxalic acid. Masses of crystals have been observed on the cap of a mushroom, some of which were sugar, while others were oxalic acid. Free oxalic acid is found in the Polyporus sulphureus, Bull., which is most likely formed at the expense of the sugar.

The only uncrystallizable sugar which is capable of fermentation is the syrup which remains after the refining of the cane and other sugars. It receives the name of molasses, and is used in medicine under the name of Sacchari faex, which is preferable to that of *theriaca*, as this might lead to confusion with a poisonous compound which bears a similar name. Molasses are largely employed for the distillation of rum.

The kinds of sugar unsusceptible of fermentation are, the sugar of milk and mannite; yet sugar of milk, when by the action of dilute sulphuric acid it is converted into granular sugar, is as susceptible of fermentation as any of the above-described. In other respects it conducts itself like common sugar, except that with nitric acid, besides oxalic acid, it forms saclactic acid. It is procured from whey, either simply by evaporating to dryness (*saccharum lactis inspissatum*), or by crystallizing it. It is frequently separated from the curd by the addition of a great many substances, which can coagulate this, such as alum, vinegar, tamarinds, and mustard, and in certain diseases these medicated wheys are much recommended.

Sugar of milk has little sweetness, but a hot solution of it tastes much sweeter than the dry sugar. Sugar of milk is much used by the followers of homoeopathy as the material of their dynamized globules.

Manna sugar constitutes the greater portion of the manna which flows from the Ornus europaea and other ashes in the south of Europe, the bark of the olive-tree, many species of pines, the root and leaves of celery, the bulb of the common onion, and in the rhizome of the Triticum repens, or couch-grass. The sweet juices of many plants, such as beet, carrots, &c., when long exposed to the air, generate manna sugar by a partial fermentation. To prevent this is one of the great objects of the manufacturer of beet-root sugar; hence the necessity for speedily concentrating and purifying this juice. To this variety of sugar probably belongs Cynodon, which exists in the root of Digitaria (Cynodon) Dactylon. And also the principle called *canellin*, obtained from canella alba.

The principle called glycyrrhizin, obtained from the liquorice-plants, and the analogous principle from the leaves of the abrus precatorius, and the root of the common polypody fern, probably belong here, as well as sarcocollin, which exists both in Penœa mucronata, P. Sarcocolla, and in the Polypody. Picromel, or the sweet principle which exists in the bile of mammals and birds, is probably a variety of sugar, though unsusceptible of fermentation, and ought to be considered in conjunction with it, from the share it may have in augmenting the sugar in diabetes.

In treating of the dietetical properties of sugar, it is necessary to view it in a variety of conditions. In temperate climates sugar is regarded as a luxury, one indeed which is nearly indispensable; but in tropical countries it is a universal article of subsistence, partly as real sugar, and partly, and more generally, as it occurs in the cane, which is either simply chewed or sucked, or softened by previous boiling. It is inconceivable what enormous quantities of the sugar cane are consumed in this way; vast ship-loads arrive daily in the market at Manilla, and in Rio Janeiro; and in the Sandwich Islands every child is seen going about with a portion of sugar-cane in the hand. In this state it is eminently nutritious. It has been called 'the most perfect alimentary substance in nature,' and the results, in the appearance of the negroes, during the cane-harvest, notwithstanding the increased severe toils of that season, seem to confirm the statement. They almost invariably become plump and sleek, and scarcely take any other food while the harvest lasts; even the sickly revive, and often recover their health. The crude plant, or the newly expressed juice, contains water, sugar, gum, green fecula, extractive, gluten, acetic and malic acids, acetates of lime and potash, supermalate and sulphate of lime, and lignin. It is the object of the various processes to which the juice is subjected, both in the countries where it is produced and where it is refined, to separate the sugar from the other ingredients, some of which dispose it to ferment and spoil, and others are obstacles to its crystallizing. (See a valuable paper by Messrs. Guynne and Young, in *British Annals of Medicine*, vol. i., p. 778; and ii., p. 42, where they enumerate tannic acid and oxide of iron among the ingredients of raw sugar.) By the removal of such of these principles as contain azote, especially the gluten and green fecula, the nutritive power of sugar is sensibly diminished. Raspail justly observes, that 'sugar will not ferment by itself; why then expect that it should ferment without albumen in the stomach? Neither sugar nor gluten taken singly are nutritive, but they become alimentary when united.' (*Chimie Organique*, sec. 886.) This fact in a great measure explains why dogs, when fed by Majendie exclusively on sugar and distilled water, invariably died in a few weeks, being thus deprived of azote. The more therefore we succeed in bringing sugar to a high state of crystallization, by the eliminating the other principles with which it is associated, in proportion do we lessen its alimentary properties. The poor therefore, who are precluded, by its high price, from using refined sugar, obtain a more nutritious article in the brown sugar which they consume. In any form Dr. Prout does not reckon sugar very nutritious, rating it as the lowest of three out of the four great alimentary or staminal principles, taking the quantity of carbon they respectively contain as the gauge of their power to maintain life: 'that is, the saccharine principles contain, on an average, from forty to forty-five per cent. of carbon; the albuminous (including azote) from fifty to seventy-five per cent.; and the oleaginous about eighty per cent. of this principle. Further, these staminal principles are all susceptible of transmutation into new principles, according to certain laws: thus the saccharine principle is readily convertible into oxalic acid; or, under other circumstances, into the modification of the oleaginous principle, alcohol.' (Prout *On the Stomach*, Introduction, p. xv.)

However harmless the use of saccharine vegetables may be to persons in health, there cannot be a doubt but that in some instances they are extremely hurtful. 'The derangement or partial suspension of the converting the saccharine principle in man into the albuminous or oleaginous, not only constitutes a formidable species of dyspepsia, but the unassimilated saccharine matter in passing through the kidneys gives occasion to the disease termed *diabetes*.' The blood of a perfectly healthy individual contains no appreciable quantity of sugar; but in diabetes, sugar has been repeatedly ascertained to exist in the sanguiferous system,—a fact unequivocally demonstrating that the assimilating organs had failed to convert the saccharine aliment into the constituent principles of the blood. Oxalic acid is neither found in the blood nor in the urine in a state of health; but in certain forms of disease probably exists in both fluids. Lactic acid, when in excess, which forms one of the most troublesome kinds of acidity in the stomach, and the frequent concomitant of *bilious attacks*, is likewise the result of such mal-assimilation generally of the saccharine matter, though occasionally of albuminous matters. The prohibition of articles of a decidedly saccharine nature from the diet of

* Poisonous honey is mentioned by Tournefort, in his 'Relation d'un Voyage du Levant,' vol. ii., p. 228, &c. (p. 66, &c. of the third volume in the English edition of 1741); and he also refers to passages of Xenophon, Aristotle, Diodorus Siculus, Pliny, and Dioscorides, in which it is alluded to.

diabetic patients becomes absolutely necessary. Not only sugar in its crystallizable states must be prohibited, but those fruits which contain it. A single peach or pear has occasionally brought back the disease in all its severity. Even those starchy or farinaceous matters which we have seen to be convertible into sugar must be avoided, especially potatoes, the starch of which is, of all others, the most easily transmuted into sugar which is of the same nature as the diabetic sugar.

The abuse of sugar is to be avoided by persons disposed to the oxalic acid diathesis; and persons of a bilious habit should use it with great moderation. (See Prout.)

Sugar, though prone to fermentation when in a dilute state, possesses when concentrated great antiseptic properties, and is extensively employed to preserve both animal and vegetable substances from decomposition. Sometimes the sugar existing naturally in many fruits is sufficient to ensure their preservation, as in figs, raisins, and other dried fruits; especially if the season has been bright and warm, when more sugar is elaborated. In other cases sugar is added, as in many preserves and jellies. Sugar added to meat, fish, &c. renders less salt necessary for keeping them, and preserves more of the natural taste and flavour. Many medicinal substances, as well as flavours and colouring principles, are preserved by means of sugar. [SYRUPS.] Sugar, from the readiness with which it reduces to a metallic state those bases which have a weak attraction for oxygen, has been proposed as an antidote in cases of poisoning with copper, corrosive sublimate, &c. It is to be doubted whether syrup is adequate to effect the reduction at the temperature of the stomach. [COPPER.] On the other hand, sugar yields oxygen to those substances which attract it strongly, such as phosphorus; hence nothing so quickly and certainly revives a fire nearly extinct as throwing a little brown sugar on the embers. Sugar burnt at a low temperature constitutes *caramel;* one part of this dissolved in four parts of water constitutes the liquor (improperly called *tinctura*) Sacchari tosti, which is employed as a colouring-matter for many liquids, especially for the dark-coloured sherries and other wines.

Refined sugar is much employed for the administration of volatile oils, constituting oleo-saccharums. Finely powdered white sugar sprinkled upon ulcers with unhealthy granulations acts as an escharotic.

The term sugar has been applied to some substances on account of their sweet taste, which are widely different from real sugar, and possess even poisonous properties, such as acetate of lead, or *sugar of lead.* Oxalic acid, another very poisonous substance, is often called, from being prepared from sugar, *acid of sugar*, and therefore thought to be harmless. Fatal accidents frequently result from this mistake. [OXALIC ACID.]

SUGAR-TRADE. Before the discovery of America, sugar was a costly luxury used only on rare occasions. About 1459, Margaret Paston, writing to her husband, who was a gentleman and landowner of Norfolk, begs that he will 'vouchsafe' to buy her a pound of sugar. (Ramsay's *Paston Letters*, i. 66.) In 1661 a duty amounting to 1*s.* 6*d.* per cwt. was imposed on the importation of British plantation sugar in England; and in 1669 the duty was doubled. From 1703 to 1747 the duty was 3*s.* 4*d.* the cwt.; 4*s.* 10*d.* from 1747 to 1759; 6*s.* 4*d.* from 1759 to 1779; 6*s.* 8*d.* from 1779 to 1781. In 1782 the duty was increased to 12*s.* 3*d.* the cwt.; in 1791 to 15*s.*; 1797 to 17*s.* 6*d.*; 1803 to 24*s.*; and after several intermediate changes in the same direction, it was fixed at 30*s.* At the last peace a reduction took place to 27*s.*; but in 1818 the former duty of 30*s.* was again charged. In 1819 however the duty was fixed at 27*s.*, and was reduced to 24*s.* in 1833, at which it still remains. From 1793 to 1803 the duty on East India sugar was 37 and 38 per cent. ad valorem, and afterwards was 11*s.* and 8*s.* the cwt. higher than the duty on West India; but by an act passed in 1836, the duties were assimilated by the reduction of East India sugar from 32*s.* to 24*s.* the cwt. The duty is 32*s.* on sugar imported from any British possession within the limits of the East India Company's territory in which the importation of foreign sugar is not prohibited. Mauritius sugar, charged at the same rate as East India prior to the 5th July, 1825, has since been admitted at the same rate as British West India. The duty on foreign sugar has been 60*s.* and 63*s.* the cwt. for the last twenty-five years; and since 1825 the latter rate has been charged.

The net revenue arising from the duty on sugar was: in

		£		Average price Cwt. in Lond s.	d.
1801	. .	2,782,232	. .	54	0
1811	. .	3,539,218	. .	41	4
1821	. .	3,660,567	. .	30	2½
1831	. .	4,219,049	. .	23	8
1839	. .	4,183,257	. .	39	4½

In 1840 and 1841 the gross revenue on sugar consumed in the United Kingdom was 4,165,006*l.* and 5,123,966*l.* respectively, being, for the latter year, nearly one-tenth of the total revenue. Fluctuations in price, and the domestic circumstances of the country, occasion great diversities in the consumption of different years. Thus, with the low price of 1831, the consumption was greater than in 1839, notwithstanding the population of Great Britain had increased nearly 2,000,000. The annual consumption averages above 20 lbs. per head for England and Scotland, and would probably be 50 lbs. if a great reduction were to take place in the price. In France the annual consumption averages 5 lbs. per head; in the States of the German League, above 4 lbs.; and in the whole of continental Europe, about 2½ lbs.

The quantity of sugar produced in different parts of the world from the sugar-cane was estimated as follows in 1839:—

Exported.		Cwt.
British sugar colonies	. .	3,571,378
British India	. . . .	519,126
Danish West Indies	. .	450,000
Dutch ditto	. . .	260,060
French sugar colonies	. .	2,160,000
United States of America	.	900,000
Brazil	. . .	2,400,000
Spanish West Indies	. .	4,481,342
Java	. . . . . .	892,475
For internal consumption, exclusive of China, India, Siam, Java, and United States	.	2,446,337
		18,080,658

The consumption of the United Kingdom is between one-fourth and one-fifth of the above quantity, but our demand is restricted to our own possessions, as the following table will show:—

YEARS.	Total quantity imported.	Quantities of Sugar retained for actual consumption in the United Kingdom. British Plantation.	East India.	Foreign.	Total quantity retained for home consumption	Net revenue from duties on Sugar.
	Cwt.	Cwt.	Cwt.	Cwt.	Cwt.	£.
1815	4,134,335	2,131,030	43,041	37,228	2,211,299	3,151,33[illegible]
1816	3,880,149	2,446,458	34,980	49,403	2,529,931	[illegible]
1817	3,911,161	3,267,034	27,332	4,575	3,298,941	[illegible]
1818	4,075,806	1,701,421	25,056	419	1,726 896	2,751,107
1819	4,198,515	2,720,609	100,046	245	2,820,900	[illegible]
1820	4,209,676	2,816,788	84,795	281	2,901,864	[illegible]
1821	4,373,166	2,936,411	120,203	268	3,056,882	4,158,958
1822	3,774,386	2,851,678	137,092	287	2,989,057	[illegible]
1823	4,201,706	3,125,907	102,901	183	3,228,991	4,107,110
1824	4,412,650	3,214,701	152,673	50	3,367,424	4,641,904
		British Plantation and Mauritius.	British East India.			
1825	3,908,135	2,972,623	107,200	25	3,079,848	4,176,655
1826	4,419,095	3,430,652	143,312	26	3,573,990	4,950,991
1827	4,110,018	3,270,885	69,856	186	3,340,927	4,640,192
1828	4,968,020	3,504,164	97,244	11	3,601,419	5,002,297
1829	4,856,393	3,421,409	118,400	12	3,539,821	4,896,242
1830	4,916,004	3,590,041	131,979	24	3,722,044	4,767,342
1831	5,366,262	3,667,396	113,536	79	3,781,011	4,650,590
1832	4,867,749	3,575,329	79,600	605	3,655,534	4,394,[illegible]
1833	4,739,292	3,553,450	98,283	71	3,651,804	4,414,302
1834	4,743,414	3,620,522	121,007	50	3,741,579	[illegible]
1835	4,448,267	3,757,851	98,680	31	3,856,562	[illegible]
1836	4,649,161	3,378,144	110,522	33	3,488,399	4,184,165
1837	4,482,578	3,684,712	270,035	43	3,954,810	4,760,565
1838	5,030,374	3,491,225	418,375	65	3,909,665	4,656,892
1839	4,678,219	3,348,298	477,252	49	3,825,599	4,586,936
1840	4,035,815	3,074,198	518,320	2,316	3,594,834	4,419,070
1841	4,734,230	2,992,142	1,066,032	257	4,054,431	. . . .

From one of the above sources, the supply, instead of being augmented with the increase of population in this country, has not been able to maintain even a stationary situation. In the following periods of five years each, the imports of sugar from the British West Indies were as under:—

1820-4	. .	3,764,360 cwt.
1825-9	. .	3,869,933
1830-4	. .	3,860,484
1835-9	. .	3,354,833

If the supply had continued to advance with the increasing population of the United Kingdom, it would now have been considerably more than 4,500,000 cwt., whereas it was only 2,202,833 cwt. in 1840; and in 1841 still less, being 2,148,980 cwt. In the former of these years the price of sugar rose higher than it had been at any period since 1817; in November the average was 57*s.* 10¾*d.* the cwt.; and at one period there was only a month's consumption of British West India sugar in bond. The equalization of the duty on East India sugar in 1836 had given a stimulus to the cultivation of the sugar-cane in the East Indies, and the import of 1840 exceeded all expectation, being 1,066,032 cwt., or above 53,000 tons. A reference to the table given above will show the great increase which has taken place in the imports from this quarter since 1837. The supply from the Mauritius increased to 705,385 cwt., which was also a larger quantity than had ever been received from that colony. The scarcity of 1840 was so great that 2316 cwt. of foreign sugar were entered for home consumption, paying a duty of 63*s.*, or 39*s.* the cwt. more than sugar from British possessions. Out of 2316 cwt. thus admitted, 1543 cwt. were from Brazil, 419 from Java, 289 from Cuba, and small quantities from Siam, the Philippines, &c. The quantity of foreign sugar in bond was about equal to the deficiency in British plantation sugar, but the greater part was excluded by the high differential duty. Brazilian muscovado was at this time worth from 20*s.* to 22*s.* in bond, of equal quality with British at 54*s.* and 56*s.* also in bond; Brazilian white sugars were 24*s.* to 26*s.*, similar in quality to white sugars from British possessions at 62*s.* and 66*s.* The sugar of Brazil, Cuba, and other foreign countries is chiefly exported to the Continent, where the price is on an average from 10*s.* to 20*s.* the cwt. lower than in this country. In the *pro forma* tariff appended to the Report on the Import Duties, it was proposed to reduce the duty on foreign sugar from 63*s.* to 30*s.*, East and West India sugar being reduced from 24*s.* to 15*s.* A reduction on British West India sugar would be of no public advantage unless it was accompanied by an alteration of the duties on foreign sugar.

In 1841 the administration of Lord Melbourne proposed to alter the sugar duties, but, being unable to retain office, nothing was done, and in the new tariff (April, 1842) sugar is one of the few articles which remains untouched.

The refining of sugar is not allowed in our colonies, but is an important branch of industry which the mother-country retains for her own advantage. Although foreign sugar is excluded from consumption by the high duties, it is allowed to be refined in bond for exportation, a drawback being paid, exceeding, it is said, the quantity of raw sugar actually used, which should be in the proportion of 34 cwt. of raw to 20 cwt. of refined. The quantity of sugar refined in bond is about 200,000 cwt. annually. In the year ending 25th June, 1840, the chief export of British refined sugar was—to Italy, 40,000 cwt.; British North America, 37,000 cwt.; Turkey, 30,000 cwt.; Russia, 20,000 cwt.; Australian settlements, 11,000 cwt.; British West Indies, 10,500 cwt. The sugar-refiner is at liberty to select the raw material from the markets of the world, when the article is intended for export, and so likewise is the exporter of raw sugar. The principal foreign countries from which we imported sugar in 1838 were—Brazil, 197,510 cwt.; Cuba, 165,022 cwt.; Philippine Islands, 144,109 cwt.; Java, 55,105 cwt.; Singapore, 31,954 cwt.; besides small quantities from the Foreign West Indies, China, and Siam. The total import of foreign sugar in 1840 was 805,000 cwt., and in 1841, 806,500 cwt., all of which, with the trifling exceptions shown in the table given above, was either exported or refined.

SUHLA′, or **SUHL**, is a thriving manufacturing town, the capital of the circle of Henneberg, in the Prussian province of Saxony, situated in a romantic valley on the river Aue or Lauter, in the forest of Thüringen, in 50° 35′ N. lat. and 10° 40′ E. long. [Thüringerwald.] It is a well-built open town, entirely surrounded with forests. It consists of about one thousand houses, with four churches, three hospitals and poor-houses, an orphan asylum, several schools, and other public institutions. The population is 7500. The inhabitants are employed in two great branches of manufacture; 1st, that of dimity and ticking, which employs between 500 and 600 looms, and produces 70,000 pieces of dimity in a year, besides ticking; 2nd, that of fire-arms, sword-blades, bayonets, and ramrods, which requires annually 7000 cwt. of iron and steel, which is supplied by nine forges in the neighbourhood of the town. In the fifteenth, sixteenth, and seventeenth centuries this was the only place in Germany where arms were manufactured. The walnut-tree for the musket-stocks is obtained from Bavaria. The inhabitants likewise manufacture fine steel articles, especially surgical instruments, and almost every other article of steel or iron. (Hassel; Cannabich; Stein.)

SUHM, PETER FREDERIK, one of the most learned and industrious writers that Denmark has produced, was the son of Admiral Suhm, and was born at Copenhagen, October 18th, 1728. Such was his extraordinary application to study, that he is said to have read not only the chief classic authors, but other works to the amount of about fifteen hundred volumes, in his father's library at Plessen, when he was not more than sixteen—a report no doubt greatly exaggerated. In 1746 he entered the university of Copenhagen, and, in compliance with his father's wishes, studied jurisprudence; but though he received, two years afterwards, an appointment in the supreme court of justice at Copenhagen, and though the most brilliant career both at the bar and in public affairs opened itself to him, he soon renounced it, devoting himself entirely to his literary pursuits, more especially to the study of northern history and antiquities. In order to acquire authentic information and materials relative to these subjects, he not only visited Norway in 1751, but remained there till 1765, when he returned to Copenhagen, where he continued to reside until his death.

Shortly after his return he began to publish the fruits of his laborious researches in a succession of historical works, all relating to Northern and Gothic annals, mythology, and archaeology, and no less remarkable for the vast erudition displayed in them, than for the prodigious literary industry of which they are a monument. One of the most valuable of them is that entitled 'Odin, or the Mythology of Northern Paganism,' 1771. His 'Critical History of Denmark,' 4 vols. 4to., 1774-81, and his 'History of Denmark,' 7 vols., 1782, &c., likewise afford a mass of information relative to the more obscure periods and antiquities of that and the other countries of Scandinavia. His industry with his own pen was equalled only by the munificence with which he patronised similar undertakings. He caused, for instance, the two last volumes of the 'Scriptores Rerum Danicarum' to be printed at his own expense; and bore the cost of publishing the Islandic 'Landnamabok,' &c., and the edition of the 'Annales Abulfedæ,' by Adler, 5 vols., 1789-94.

In addition to his various and vast labours as an historian, Suhm distinguished himself also in several other branches of literature, including poetry. His 'Idyls,' indeed, although not without merit, have little interest at the present day; but his prose 'Tales' founded upon northern legends and traditions are deservedly popular, and entitle him to be considered the originator of that species of historical fiction, which has since been brought to perfection by Scott. These and his other miscellaneous productions form the collection of his 'Samlade Skrifter,' in 16 vols., 1788-99.

Suhm not only formed at great expense a most valuable collection of books, amounting to upwards of one hundred thousand volumes, but freely opened it to the public, librarians and attendants being kept by him for that purpose; and he continued to augment it—appropriating to that purpose the yearly sum of 5000 dollars—until he consented that it should be incorporated with the royal library, in 1796, on conditions which sufficiently attest that noble-minded disinterestedness which, after literary enthusiasm, formed the leading trait of his character. His death, which was occasioned by gout, took place on the 7th September, 1798. (Eichhorn, *Geschichte der Litteratur.*)

SUICER (SCHWEITZER), JOHN GASPAR, or **CASPAR**, was born at Zürich in 1620, and after studying at Montauban, returned to Switzerland, and became the pastor of a country commune in 1643. In 1660 he became professor of Hebrew and Greek in the University of Zürich, and devoted himself especially to the study of the Greek fathers. He resigned his chair in 1683, and died on the 29th of December, 1684.

His chief work, the reputation of which is still great, was his 'Thesaurus Ecclesiasticus, e Patribus Graecis, ordine alphabetico, exhibens quaecunque Phrases, Ritus, Dogmata, Haereses, et hujusmodi alia huc spectant,' Amst., 1682,

2 vols. fol.; best edition, Amst., 1728, 2 vols. fol., with a supplement by his son. He is said to have been engaged upon this work for twenty years.

Suicer wrote three other works, on the Nicene Creed and other points of Oriental church history, besides a Greek Syntax and a Greek and Latin Lexicon.

SUICER, JOHN HENRY, son of the above, was born at Zürich on the 6th of April, 1644, and received a learned education from his father, to whose profession he also devoted himself. After travelling over part of Switzerland and Germany with a pupil, he was recalled to Zürich, and received an appointment to the gymnasium of that town. In 1683 he succeeded his father in his professorship, and in 1700 he was appointed to the chair of theology in the University of Heidelberg, but fell ill shortly after his arrival in that town, and died there on the 23rd of September, 1705.

Besides the Notes to his father's 'Thesaurus,' he wrote, 1, 'Compendium Physicae Aristotelico-Cartesianae,' Amst., 1685; Bâle, 1691; 12mo.; 2, 'A Commentary on the Epistle of Paul to the Colossians,' Zürich, 1699, 4to., to which are added, in the same volume, three discourses, 'De Fortunis Graecae Antiquae,' 'De Graecia Christiana,' and 'De internis Ecclesiae reformatae Terroribus;' 3, 'Specimen Commentarii in Epistolam ad Ephesios,' in the 'Miscellanea Duisbergensia.'

J. H. Suicer is sometimes confounded with an ancestor of the same name, who wrote 'Chronologia Helvetica, res gestas Helvetiorum ad nostra usque tempora complectens,' Hanau, 1607, 4to.; reprinted in 1735, in the 'Thesaurus Helveticus' of Fueslin. He places the foundation of Zürich in A.M. 1980, but he is a trustworthy historian of modern times. He also wrote a history of Switzerland down to the year 1532, which is preserved in MS. in various libraries.

(*Life of J. H. Suicer*, by J. R. Wolff, Zürich, 1745; *Biographie Universelle*.)

SUICIDE is the term usually applied both to the act of self-destruction and to him who commits it. Of the many views in which it may be considered, that is at once the most definite and the most important in which it is regarded as a subject of medical investigation. It will therefore be adopted in the present article.

In this view the most important distinctions among cases of suicide are founded on the circumstances which lead to its commission; and of these there are two chief classes: in one, a man is led to disregard his life for the sake of something for which his death is necessary; in the other, he is depressed by an evil more intolerable than the act of dying. But whichever of these be the motive, it may act in two different ways, and the suicide may be, as M. Esquirol has said, either acute and involuntary, or chronic and prepense. Or, again, suicides of all kinds may be divided (and this is probably the most practical method) according to the condition of the mind which has preceded the act, and which in each case constitutes the disposition to self-destruction.

In many cases this disposition is only a part of the general perversion of the judgment in complete insanity: it thus exists in certain maniacs in combination with many other signs of a diseased mind. Some are merely melancholy; some are carried on by illusions which lead them, as if unintentionally, to suicide; some have sensations which they imagine may be cured by such violence as proves fatal; some are driven to the act by commands which they imagine they have received; some destroy themselves at the commencement of insanity, when they are conscious of the malady which threatens them; others, in their convalescence, in horror at the excesses which they have committed, or at the mere thought of having been deranged.

There are also cases of monomania in which almost the only indication of insanity is the desire for self-destruction, excited by an illusion respecting some melancholy event, or by some fancied command. There is a peculiar and very terrible variety of this monomania, in which the desire for destruction leads the patient to take the lives of others, against whom he bears no ill-will, before he attempts his own. Many instances of this homicidal monomania, as it is called, are recorded; and only recently (March, 1842) one of the worst examples of it has occurred in London, a man murdering three of his children and himself, in circumstances which could leave no doubt of his insanity.

There are conditions of the mind which are not called insanity (in the ordinary acceptation of the term), but which do not less strongly predispose to suicide. Such is especially that named *ennui*, or *tædium vitæ*, for which, though it is thought by foreigners to be so common in England, that Sauvages has called it 'melancholia Anglica,' we have in our language no term except the very inexpressive one, *spleen*. Many circumstances give rise to this state of mind. It occurs sometimes in young persons who grow sad, with a passive anxiety for some object, they hardly know what; who complain that they are useless in the world, or not cared for, and slowly pine away or destroy themselves. But more commonly it is the consequence of a want of occupation, or of a sudden transition from a state of active exertion in business or in pleasure, to one of voluntary or compelled repose; or it results from the difficulty which those who have long lived in the excitement of frivolous pursuits find in maintaining it by new objects of desire.

The state of the hypochondriac, though of somewhat the same kind, is less dangerous. He is persuaded indeed that his sufferings are irremediable, and that death would be a great relief to him; he even often talks of committing suicide; but he is as irresolute in the use of the means of death, as he is anxious in the use of those of prolonging life; and if he do at last, after repeated postponements, attempt to destroy himself, the attempt is generally, through want of determination, abortive, and he again sinks into the same despondency and inactivity.

In all these cases the suicide is of the chronic or prepense kind; and in all, the condition of mind which precedes it is connected with a perversion of the judgment so obvious, that no reasonable person could hesitate to regard it as insanity. Whatever ingenuity of plan may have been shown in the preparation for the act, very few persons would deny that, under similar external circumstances, it would not have been committed by a sane man; and this is true of the great majority of prepense suicides in the present day.

In the acute or involuntary suicides, the predisposing condition of the mind is the result of circumstances which act rapidly, and pervert a judgment which, before their occurrence, might be deemed sound. Suicides of this kind are probably less frequent than those of the preceding; but they are usually more shocking, and attract more attention: they are especially common in large towns, or wherever men pursue great objects at great hazards. For instance, a loss of money or of honour, the failure of an ambitious enterprise, jealousy, and many afflicting events, are enough at once to deprive a man of tender sensibility of the power of just reflection, and to make him think that death is not so bad as the misery which he must undergo. On the spur of the moment of anguish he destroys himself. Similar circumstances impel a man of colder temperament or of a braver disposition more slowly to the same end. The one may for a time endure passively his disgrace; the other may have courage at first to bear up against it; but at length the judgment is in both alike perverted, and the same state of mind is produced which urges others to immediate self-destruction.

Lastly, there are examples in which suicide is committed with perfect coolness, being adopted, after due deliberation, as the most judicious course which, in the circumstances of the case, and as far as the knowledge of the individual enabled him to judge, could be followed. Such are many of the cases in which men, finding themselves afflicted with incurable and painful diseases, have shortened that which they believed would be a miserable life; and of the same class are the suicides committed in accordance with national custom, or superstition, or from patriotic motives. The cases of this class are not proper subjects for medical consideration, for in these there is no disorder of the mind. The act is committed either without deliberation, in obedience to custom or authority; or, when deliberation is used, the conclusion is only the necessary result of the error in the premises.

Such are the states of mind which most commonly predispose to suicide and the circumstances which produce them. The character of the act itself usually corresponds closely with that of the mind by which it is urged. By those who commit it after deliberation, the means employed are almost always successful: so they are when men who have endured affliction for some time, at last sink under it. But when suicide is attempted under the sudden impulse of the fear of disgrace, the endeavour is often abortive; the means chosen are insufficient, or they are awkwardly employed; and it deserves notice, that the attempt generally seems to be the acme of the frenzy: for if it be unsuccessful, it is very rarely repeated, and often he who has made it, in the next minute seeks assistance and bitterly repents his folly

There are other circumstances of which the influence in producing the disposition to suicide is less obvious, and is detected only by a statistical comparison of the number and characters of the suicides committed under their influence and beyond it. Such are the varieties of climate, of habits of life, of age, &c., on all of which reports, more or less accurate, have furnished useful information.

The names of the following countries are placed in the order of the respective proportions of suicides to the population:—the United States, England, Prussia, France, Austria, Russia, Italy, Spain.

It is a generally-received opinion that cold foggy climates favour the development of the suicidal disposition; but in Holland, the climate of which is very similar to that of Great Britain, the proportion of suicides is lower than in any of the countries just enumerated; and that many circumstances are capable of counterbalancing whatever influence climate may have, is proved by the number of suicides in the same country having varied considerably in different periods.

In accordance with the same general opinion, it is commonly said that suicides are more frequent in the latter part of the autumn than in any other season; but the kind of weather which is most favourable to the suicidal disposition is that of long-continued heat and drought. Of 1131 suicides committed at Berlin, Hamburg, Westminster, and Paris, there were, in the first quarter of the year, 237; during the second, 299; during the third, 335; and, during the fourth, 260. A similar influence of the spring and summer weather in favouring the disposition to suicide is proved by the statistics of M. Esquirol at the Salpetrière, and by those of M. Prevost, who found that of 133 suicides committed in Geneva in ten years, the number in each month was as follows:—April 19, June 17, August 17, July 15, October 14, May 13, March 10, November 9, September 6, January 5, February 5, December 3. From the returns of coroners' inquests in Westminster (*Journal of the Statistical Society*, vol, i.) it appears that in the first quarters of twenty-five years there were 169 suicides, in the second 182, in the third 159, and in the fourth 146. The greatest numbers occurred in June, July, and March. From all these facts there can be no doubt that spring and summer have a worse influence on the suicidal disposition than either autumn or winter.

The tendency to suicide varies greatly among persons of different stations and occupations. In a recent letter from Mr. Farr to the registrar-general, this tendency is shown to be 'least among persons who carry on occupations out of doors, and greatest among artisans who are weakly from birth, are confined in-doors, have their rest disturbed, or have little muscular exercise.' The proportion of annual suicides among masons, carpenters, and butchers, for example, is 1·33 to 10,000; and among tailors, shoemakers, and bakers, 7·43 to 10,000; and, in general, 'the tendency to suicide is twice as great among artisans as it is among labourers.' It is not proved that education has, as many have asserted, a tendency to increase the number of suicides: its influence in this respect is not at all discernible. Neither does the state of poverty or wealth seem to have any material influence; but what all returns agree in proving is, that among the inhabitants of large cities and their neighbourhoods, suicides are much more frequent than among those who live in the rural districts. M. Guerry has shown (*Statistique Morale de la France*) that the frequency of suicides in France regularly decreases as the distance from Paris increases, and that this rule holds true of all the departments except that in which Marseille is situated, for this town has the same influence in exciting the disposition to suicide which Paris has. Similar results were obtained by Prevost from statistics collected at Geneva, and they are completely confirmed by general observation in England, though, from commerce and pleasure being less centralised in our metropolis than they are in those of most continental kingdoms, the difference is not so easily discernible.

The tendency to suicide is much more frequent among men than among women. By the Westminster Return, already quoted, it is shown that in twenty-five years 478 males and 178 females destroyed themselves: the proportion therefore is as 73 to 27. Nearly the same proportion was observed by M. Prevost in the suicides in Geneva; and M. Esquirol, comparing the results of several tables, says the proportion may be stated generally as three males to one female.

There is sufficient reason to believe that in the married state the disposition to suicide is less than in single life. Some difference in this respect however is noticed by M. Prevost between the sexes; for he found that though the number of suicides among married men was less than that among single men, the proportion among married and single women was just the reverse.

The following table will show at once the variations in the disposition to suicide at different periods of life. The first column indicates the ages; the five next columns show how many suicides. in every thousand that are committed in each of four different places, are committed by persons of those several ages; and the last column shows the proportion of persons of each of those ages in every thousand of the whole population, exclusive of children under ten years old.

Age.	Berlin.	Paris. By gun-shot.	Paris. By hanging.	Salpêtrière.	Geneva.	Prop. per 1000 of pop. above 10 y.
10 to 20 years	224	61	68	91	53	312
20 to 30 „	251	283	51	282	252	188
30 to 40 „	96	182	94	272		160
40 to 50 „	156	150	188	237	474	136
50 to 60 „	146	161	256	66		100
60 to 70 „	77	126	285.	46	221	68
70 to 80 „	41	35	108	16		30
80 and upwards	9	2	0	0		6
	1000	1000	1000	1000	1000	1000

It thus appears that the disposition is greatest between the ages of 20 and 30, both absolutely and relatively to the whole number of persons living at those ages.

Under the head of Paris in the preceding table the suicides are arranged according to the means by which they were perpetrated. Many returns have been made to determine the proportion in which each method of self-destruction is employed in different places; but they are of little value, for it seems to be determined by the opportunities most conveniently afforded in different situations, and by the fashion (if one may so speak) which exists at particular times for one method or another. In the neighbourhood of lakes and rivers or canals, for example, drowning is always the most frequent method of self-destruction; in places more remote from large quantities of water, hanging or shooting.

From the various degrees of force with which the preceding circumstances operate, and from the influence of others which are not separately capable of being appreciated, it results that the proportion of suicides in different countries, and in the same country at different times, varies widely. The following calculations will show pretty accurately the degrees of difference:—in Westminster, the proportion of suicides annually, between 1832 and 1836, was 1 to every 6379 of the population; in London the proportion is in general as 1·33 to 10,000, in those who follow hard labour out of doors; as 7·43 to 10,000 in those who pursue sedentary occupations; and as 4 to 10,000 among paupers. The number of persons who are known to commit suicide in England amounts to about 1000 annually; and besides these there are many who, being found drowned, without any evidence whether their deaths were accidental or intentional, are not returned among the cases of suicide. According to M. Quetelet, the proportion of suicides annually is, in—

Russia . .	1 to 49,182	inhabitants.
Austria . .	1 to 20,900	„
France . .	1 to 18,000	„
State of Pennsylvania	1 to 15,875	„
Prussia . .	1 to 14,404	„
City of Baltimore	1 to 13,656	„
Boston . .	1 to 12,500	„
New York. .	1 to 7,797	„

In and around Paris the suicides between—

	1817 and 1825	were 1 in 2,400	inhabitants.
Berlin .	1813 and 1822	„ 1 in 2,941	„
Geneva .	1820 and 1826	„ 1 in 3,985	„
London .	. . .	1 in 5,000	„

In Paris the average annual number of suicides was,—

From 1817 to 1821 .	346 or 1 in 1,971	inhabitants.
From 1822 to 1826 .	397 or 1 in 2,612	„
From 1829 to 1833 .	465 or 1 in 1,665	„

In 1835 there were 574 suicides.

In Paris therefore there appears to have been a regular increase in the number of suicides from 1822 to 1834; but

in England there is no reason to believe that a similar augmentation has taken place. From the Westminster return already quoted, it appears indeed that the annual average number of suicides there has increased, but their increase has not been in a proportion corresponding to that of the population. Thus, dividing the time into periods of five years, the average annual number of suicides was—

From 1812 to 1816	. .	25·8
„ 1817 to 1821	. .	20·2
„ 1822 to 1826	. .	23·8
„ 1827 to 1831	. .	29·8
„ 1832 to 1836	. .	31·6

But comparing these numbers with those of the population at the census immediately preceding each of three quinquennial periods, it appears that the proportion of the number of suicides to that of the population was—

After 1811	. . .	1 in 6232
1821	. . .	1 in 7623
1831	. . .	1 in 6379

From what has now been said of the variety of causes which may engender or encourage the disposition to suicide, it must be manifest that no general account can be given of the morbid conditions of the body, or of the brain, which accompany the mental disturbance. Many facts relating to this part of the subject have been related; but as yet they are unconnected by any generalization. We may therefore proceed at once from the causes to the treatment of the suicidal disposition.

Here also what has been said of the one may serve for a guide to the knowledge of the other. With respect to the treatment of those among the insane who exhibit a tendency to self-destruction, there can be no other deviation from the ordinary treatment of insanity than that which consists in the careful removal from them of all means by which their intentions may be accomplished. Both for these and for those who show no other sign of insanity than their desire for death, the most successful remedy is the giving full occupation for the time: this is indeed essential to the safety of all who show any disposition to suicide. The occupation moreover should be one which will carry the mind as far as possible from the subjects on which it is morbidly sensitive, or on which it has been accustomed to dwell too intently. Above all, a person suspected of an intention to commit suicide should be kept carefully from the contemplation of histories of self-destruction. Numerous instances have proved that the tendency to imitate the acts of others operates as forcibly in producing suicides as in encouraging the most trivial fashion. Only last winter (1841) there was in London a kind of epidemic mania by which persons, exhibiting no other signs of insanity and urged by no strong motive of despair, felt irresistibly impelled to attempt to drown themselves, especially by jumping off the bridges into the Thames. Scarcely a night passed without one or more such occurrences, till the same remedy was applied which had in many similar instances of epidemic suicidal mania proved successful. All who were brought before the magistrates charged with attempts to drown themselves were punished by a short imprisonment; and within a few days after it became known that this plan was being followed, the epidemic ceased. In other instances it has been found that the horror of being disgraced after death has been sufficient to deter men from imitating others in the commission of suicide. For all cases of imitative suicide therefore there is a plain preventive means which should never be neglected; and the fact which the histories of these epidemics furnish, namely, that the fear of being disgraced after death operates forcibly in deterring men from suicide, is a sufficient proof of the imprudence of the opinion which regards suicide as affording by itself sufficient evidence of the insanity and irresponsibility of those who commit it. If it be desirable to diminish the number of suicides, the practical rule should be to place suicides and homicides on the same level; and not to remit the appropriate punishment for either except on the clearest proof of such insanity as renders a man by common consent irresponsible.

SUICIDE is death caused by the act, voluntary or involuntary, of the party dying.

A rescript of Hadrian expressly directed that those soldiers who, either from impatience of pain, from disgust of life, from disease, from madness, from dread of infamy or disgrace, had wounded themselves or otherwise attempted to put a period to their existence, should only be punished with ignominia (*Dig.*, 49, tit. 16, s. 6, 'De Re Militari'); but the attempt of a soldier at self-destruction on other grounds was a capital offence; and those who, being under prosecution for heinous offences, or being taken in the commission of a great crime, put an end to their existence from fear of punishment, forfeited all their property to the Fiscus. (*Dig.*, 48, tit. 21, s. 3.) Suicide was not uncommon among the Romans in the later republican period; and it became very common under the emperors, as we see from the examples in Tacitus, and in the younger Pliny, who mentions the case of Corellius Rufus (*Ep.*, i. 12), Silius Italicus (iii. 7), Arria (iii. 16), and the woman (vi. 24) who succeeded in persuading her husband, who was labouring under an incurable disease, to throw himself, tied to her, into a lake. [Silius Italicus.] Except in the cases mentioned in the two titles of the 'Digest' above cited, suicide was not forbidden by the Roman law; nor was it discountenanced by public opinion.

Voluntary suicide, by the law of England, is a crime; and every suicide is presumed to be voluntary until the contrary is made apparent. This crime is called self-murder and felonia de se (self-felony), neither of which terms is calculated to convey a correct notion of the legal character of this offence, or of the mode in which it is punished.

A felo de se (self-felon) is a person who, being of years of discretion and in his senses, destroys his own life, either intending to do so, or intending to do some other act of a character both unlawful and malicious; as if, in attempting to kill another, under circumstances which would have rendered such killing either murder or manslaughter, a gun bursts in the assailant's own hand, or he runs upon a knife *casually* in the hand of the person whom he intended to kill. Death occasioned by falling upon a knife held up in his defence by the party assaulted, would not be suicide by the assailant, but justifiable homicide by the party assaulted. [Murder.] But in no case is self-felony considered to be committed if death do not ensue within a year and a day of the blow or injury; or, in other words, if a whole year intervene between the day on which the blow, &c. is given, and the day on which death takes place.

The legal effect of a self-felony is a forfeiture to the crown of all the personal property which the party had at the time he committed the act by which the death was caused, including debts due to him, but though the crime is called felony, it was never attended with forfeiture of freehold, and never worked any corruption of blood. It appears however that formerly the crown was entitled to the year, day, and waste of the freehold lands of a self-felon; as we find that in 1289 the widow of Aubrey or Albert (Alberici) de Wytelesbury gave 300*l.* to the king (Edw. I.) to have all the goods and chattels of her husband, 'a felon by drowning himself,' saving to the king the year, day, and waste of Aubrey's lands and tenements. (2 Madox, *Exch.*, 347.)

The fact that a self-felony has been committed is ascertained by an inquest or inquisition taken before the coroner or other officer having authority to hold inquests, upon view of the dead body, and examination of witnesses in the presence of a jury, summoned, as in other cases, to inquire into the cause of a sudden or violent death. [Coroner.]

Where a self-felony is found by the inquisition, the jury ought also to inquire and find whether the party had any, and, if any, what goods and chattels at the time when the felony was committed. But an omission in this respect may be supplied by an inquisition taken by the sheriff under a writ De melius inquirendo, or 'further inquiry.' The property in the self-felon's goods, upon being found in either of these modes, is vested in the crown with relation to the time of the felony, so as to make any intermediate dealing with the property void as against the crown.

If any part of the goods happen to be in the possession of a person who refuses to deliver them up, or if any debtor refuse to pay to the crown the amount owing from him to the self-felon, a personal information, in the nature of an action of trover, in the one case, and of debt in the other, is exhibited against him, generally in the Exchequer. (Mann., *Exch. Pract.*, *Revenue Branch.*)

The crown takes the property of the self-felon subject to no liability in respect of his debts or engagements. Upon a memorial presented to the treasury by a creditor of the deceased, a warrant under the sign-manual is however generally obtained, authorising the ecclesiastical court to grant letters of administration to such creditor, who, upon such grant being made, acquires the ordinary rights, and

becomes subject to the ordinary liabilities of a personal representative.

It was formerly usual for the crown to make grants to its servants and favourites of the property arising from these and other forfeitures. These grants were either of particular forfeitures, or of forfeitures accruing within a particular district. Grants of the latter description were usually made in fee simple, and many such grants are still in force in various parts of England. An act was passed in 1693 (4 & 5 W. and M., c. 22) to relieve such parties from the necessity of litigating their rights with the crown whenever a forfeiture occurred, by directing that, after the inrolment of such grants in the court of King's Bench, no process should be issued on the part of the crown to question the right of the grantees.

The finding of the jury is not conclusive either as to the fact of self-felony or as to the property of the deceased; and all persons interested in controverting any part of the finding may plead to the inquisition, and contest its sufficiency by a demurrer, or deny its truth by a traverse. The issues, of law or of fact, raised upon such pleadings, are disposed of as in other cases. [PLEADING.]

Formerly coroners returned their inquests into the court of King's Bench, in order that process might issue against those who made seizures, set up claims, or withheld property or debts in derogation of the rights of the crown. (*Rex* v. *Sutton*, 1 Saunders, 270.) Since the passing of 4 & 5 W. & M., c. 22, that practice has been discontinued; and the course now is, that any party who considers himself aggrieved by the finding of the coroner's jury obtains a writ of Certiorari from the court of King's Bench, by which the coroner is required to return the inquisition. The return being made, if the court, upon inspection of the inquisition, see clearly that it cannot be supported, in consequence of some legal defect, they will quash it without putting the party to the expense of a demurrer. If however the inquisition be good in substance, the coroner may be ordered to amend defects in form.

Involuntary suicide is where death is occasioned by the act of the party, either without an actual intention of destroying life or of committing any other wilful malicious act, or without the legal capacity of intending to do so. The first class of cases may be established by showing that the act was done with some other intention. The practical difficulty generally arises upon the second class. Neither self-felony nor any other crime can be committed by a child who has not attained years of discretion; nor can it be committed by a person who, by disease or otherwise, has lost, or has been prevented from acquiring, the faculty of discerning right from wrong. A tendency to self-destruction is common in several species of insanity, and the connection between the morbid affection and the act of violence which occasions death may often be very distinctly traced. It not unfrequently happens however that cases arise in which it is nearly impossible to determine whether the act is to be ascribed to a diseased state of the mental faculties, or to passions which are not under the ordinary restraint.

At common law, which in this respect follows the canon law, a person found by inquest to be felo de se is considered as having died in mortal sin; and his remains were formerly interred in the public highway without the rites of Christian burial, and a stake was driven through the body: but by the 4 Geo. IV., c. 52, the coroner or other officer by whom the inquest is held is required to give directions for the private interment of the remains of any person against whom a finding of felo de se shall be had, without any stake being driven through the body, in the churchyard or other burial-ground of the parish in which the remains of such person might by the laws or customs of England be interred, if the verdict of felo de se had not been found; such interment to be made within twenty-four hours from the finding of the inquisition, and to take place within the hours of nine and twelve at night, without performance of any of the rites of Christian burial.

The Code Pénal of France contains no legislation on the subject of suicide. Of the modern codes of Germany, some adopt the silence of the French code, and others vary in their particular provisions. In the Bavarian and Saxon codes suicide is not mentioned. The Prussian code forbids all mutilation of the dead body of a self-murderer under ordinary circumstances; but declares that it shall be buried without any marks of respect otherwise suitable to the rank of the deceased; and it directs that if any sentence has been pronounced, it shall, as far as it is feasible, be executed, due regard being had to decency and propriety, on the dead body. Besides which, the body of a criminal who commits self-murder to escape the execution of a sentence pronounced against him is to be buried at night by the common executioner, at the usual place of execution for criminals. The Austrian code simply provides that the body of a self-murderer shall be buried by the officers of justice, but not in a churchyard or other place of common interment.

SU'IDÆ, Swine; *Sus*, Linn.; a family of PACHYDERMATA of high importance to man for economical purposes.

The swine have on each foot two large principal toes shod with stout hoofs, and two lateral toes which are much shorter and hardly touch the earth. The incisor teeth are variable in number, but the lower incisors are all levelled forwards. The canines are projected from the mouth and recurved upwards. The muzzle is terminated by a truncated snout fitted for turning up the ground, and the stomach is but little divided.

ORGANIZATION.

Skeleton.—Cuvier remarks that the *skull* of a hog is nearly a quadrangular pyramid, the palatine surface of which is almost perpendicular to the base, represented by the occiput. The nasal bones occupy the upper part of the muzzle; their base is slightly widened; the other extremity advances a little pointedly above the nasal aperture. The intermaxillaries ascend rather obliquely to one-third of the length of the nasal bones, and carry at their extremity the peculiar bone which supports the snout. The orbit is round, and well defined (cerné) by an advance of the frontal and the two post-orbital apophyses, the portion formed by the frontal especially is well marked. Between the two it is nearly the sixth of a circle, not closed. The frontals descend in front of the orbit more than a fourth of the length of the muzzle before they encounter the nasal bones. The lachrymal bone occupies a rather large rhomboidal space upon the cheek. The two lachrymal holes are pierced, the upper one on the border itself, the other a little in front of the border of the orbit. In the orbit, the lachrymal descends to the upper border of the vault of the suborbital canal. The jugal bone is articulated to the whole width of the lachrymal bone. It is elevated, and the suture with the temporal bone behind the post-orbital apophysis descends at first, and afterwards becomes horizontal. The zygomatic apophysis of the temporal bone ascends a little, and rises to a point backwards above the auditory meatus. The temple is well marked by a parietal crest, which goes to the occipital without touching its congener; so that the occiput is truncated squarely above, where it widens a little. The palate is prolonged a little behind the origin of the zygomatic arches. The palatine bone advances no farther than just before the last molar tooth. It is prolonged a little on each side, where it terminates in form of a tubercle between the two pterygoid wings. It ascends into the orbit, showing nothing there but a process (languette) by no means large, which pushes forward into the internal walls of the suborbital canal. The internal pterygoid apophyses are distinct from the body of the bone, high and narrow, and terminated in a hook. The external apophyses at least equal them, make one with the body of the bone, and also terminate in a hook. In the temple the posterior sphenoid is nearly reduced to the anterior surface of the external pterygoid apophyses. It articulates itself with the temporal bone, does not touch the frontal except with its point, and does not reach the parietal. The anterior part occupies most space there, and it permits nevertheless the frontal bone to descend in front of it till it reaches the palatine, and even to bend itself back to enter into the vault of the suborbital canal between the maxillary and the palatine bones. The temporal bone raises itself rather high in the temple, where its parietal suture curves downwards. It occupies a part of the occiput on each side, and its suture comes in front of the base of the mastoid apophysis, which is very long, very pointed, and entirely belonging to the occipital bone. The tympanic cavity (caisse) is a very projecting tubercle, not to say pointed, in front of this apophysis. It receives a very long and very narrow auditory meatus, which commences very high behind the posterior base of the arcade. Its cavity is very small, and the whole of its apparent volume consists only of cellular osseous substance. The glenoid facet is projecting and much wider than it is long, between the arcade and the tympanic cavity, which last is early ossified in its convex portion, and seemed to Cuvier to

belong to the temporal bone, from which it is not separated even in the fœtus, but the petrous bone (rocher) is long distinguishable: this last does not appear externally. The two frontal bones unite together early, and the two parietals still earlier: there is no interparietal in those subjects which have seen the light. The suborbital hole is rather large, above the fourth molar, nearly in the middle of the maxillary bone. Its canal opens widely in the orbit, at the ordinary place. The lachrymal holes have been already noticed. There is below the orbital surface of the orbital bone a deep hollow without issue, the use of which was unknown to Cuvier. At the upper vault of the orbit is a suborbital hole, which conducts to an aperture pierced on the front. The orbital hole is near the suture with the anterior sphenoid. The analogous holes to the spheno- and pterygo-palatine bones are in the suborbital canal. The last enters the palate opposite the penultimate molar. The optic and spheno-orbital holes, are approximated as ordinarily, and rather large. The oval aperture is separated by the whole external pterygoid apophysis, the direction of which is transversal. It is common to the sphenoid and temporal bones, and is only separated by a small bony ridge from a large carotidian hole, which answers in part to the internal side of the tympanic cavity. Under the junction of the anterior sphenoid to the posterior is a double canal, which goes into the thickness of the vomer. The posterior foramen lacerum, the stylo-mastoidian, and the condylodian are very much approximated near the mastoid apophysis. At the interior one may see that the frontal and sphenoidal sinuses are very much extended, and narrow the cerebral cavity a good deal. The first-named sinuses extend to the occiput. The sella ascends nearly vertically to sustain the optic nerves. The bony tentorium only exists on the sides, it does no more than pass upon the petrous bone. The ethmoidal fosset is very much sunk, of moderate size, divided by a very salient crest, and riddled with numerous holes. The area of the cerebral cavity is only half that of the cranium, as it appears externally, so much is it augmented by the great sinuses which exist even to the occiput.

Different *Suidæ* offer more or less variations in the length of the head.

The Wild Boar (*Sus Scrofa*, Linn.) has the face longer and the skull less elevated; the domestic pig of Europe has the cranium slightly more elevated, and the face still sufficiently long; the Siamese pig has the face shorter, the cranium more convex in the frontal region, and larger in proportion.

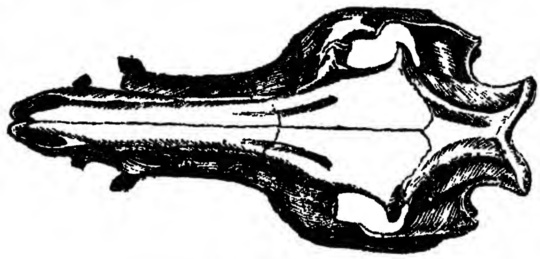
The Masked Boar of Africa differs from the European boar in having its *zygomata* extending more outwards and taking a more horizontal direction, and especially by a great elevated apophysis, above the alveolus of the canine tooth, and ascending obliquely so as to leave a canal between it and the maxillary bone. It terminates by a great rugged tubercle, and the nasal bone opposite to a similar tubercle. It is to these two prominences that the great warts or mamillæ, which give this animal so hideous an aspect, adhere.

The Babiroussa, when compared with a Siamese hog of the same size, has the cranium longer in proportion to the muzzle, the orbit more advanced, the temporal fossæ more approximated on the cranium, the zygomatic arch longer and ascending less suddenly backwards, and the tympanic cavities much longer.

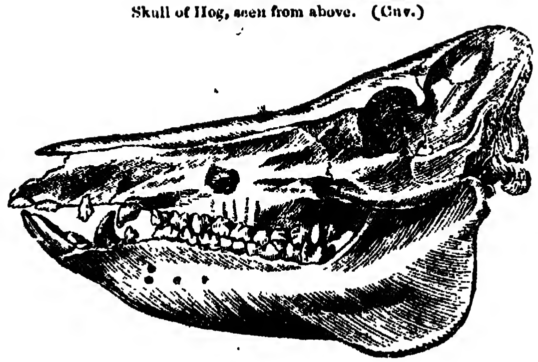
The peculiar character of the Ethiopian boar (*Phacochœrus*) consists in the retreat of the eyes and the relative smallness of the temporal fossæ, the necessary consequence of that retreat; in the enormous development of the base of the zygomatic arches; and in the width of that part, as well as in the interval between the orbits. The alveoli of its enormous canines form a projection on each side of the muzzle, which is terminated by two small peculiar bones that unite the extremities of the nasal to those of the intermaxillary bones, and which correspond to the single bone carried on the extremity of the intermaxillaries in the common hog. The tympanic cavities are small, terminated in a point. The basilary part has between them a hook projecting on each side, and in front are two very deep and very remarkable fossæ prolonging the vault of the back nostrils, and hollowed, principally, in the sphenoid bone.

The Peccary approximates more to the *Babiroussa* than to the Siamese hog, but its muzzle is still shorter; the tympanic cavities are rounded and cellular; its mastoid apophyses are very short and directed backwards; its palate is prolonged, narrowing as it retires, more backward than its molars. Its glenoid facet is very different from that of the hog, and fenced (cernée) in front and behind as in some of the *Carnivora*.

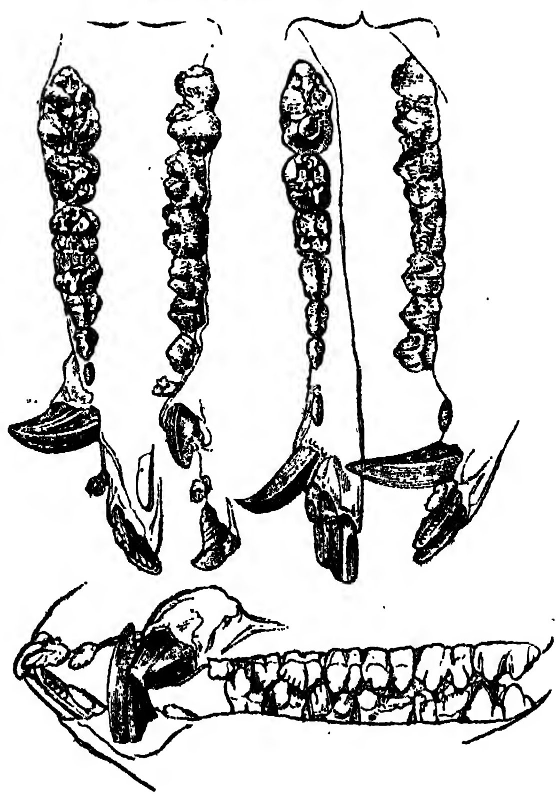
Cuvier remarks that the relationship of the *Suidæ* with the *Carnivora* is very close, indeed that there is no difference in the anterior part of the cranium. Take, says he, the head of an opossum (Sarigue) for example; shorten the cranium; widen the orbits and parietal crests; raise the occiput, shortening at the same time the basilary part and the back nostrils, and you will only require the differences of projection of some parts, the presence of an external pterygoid apophysis, the direction downwards of the curvature of the zygomatic arch, &c., to arrive at the head of a hog. In the pterygoidian and neighbouring parts, the kanguroo approaches it still nearer.



Skull of Hog, seen from above. (Cuv.)

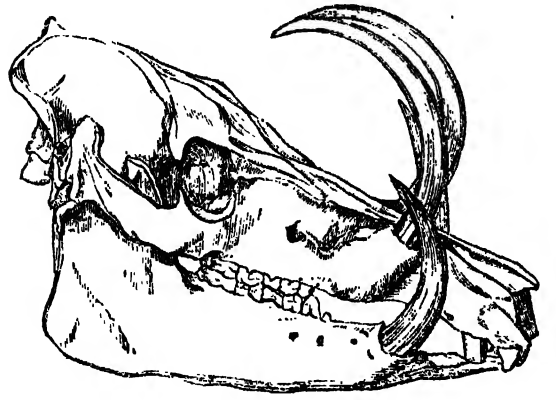


Skull of Hog, seen in profile. (Cuv.)



Teeth of Hog. (F. Cuv.)

The dentition of the hog has its characters and laws, like that of all other animals. The normal number of its teeth is six incisors, two canines, and fourteen molar teeth in each jaw. (*Ossemens Fossiles.*)



Skull of Babiroussa.

The *dentition*, as we shall presently see, varies in the different species, especially in *Phacochœrus*.

The *extremities* of the hog have much relationship to those of the RUMINANTS, especially of the sheep and the stag.

The spine of the *shoulder-blade*, as in the horse, is nearly at an equal distance from the anterior and posterior border; whilst in the ox and stag it is much nearer to the anterior edge. This spine, as in the horse again, is lowered before, and more projecting at its upper third, where it forms a hook bent backwards. In other respects, it is wider in the upper part than that of the horse, its coracoid tubercle is less projecting, and its articular surface higher than it is wide. The great tuberosity of the *humerus* is very high, as in the Ruminants; but it is notched by a large re-entering arch; the bicipital groove is, on the internal side, narrower and deeper; the whole upper part of the head of the bone is narrower in proportion. The *ulna* is wide and depressed, with a ridge on its anterior surface, forming with the internal edge a long hollow surface, by which in advancing age it is soldered to the radius. In the ruminants it is more compressed and much more slender. In the Peccary it is soldered sooner and more completely than in the hog. The *carpus* much resembles that of ruminants, with this difference that the trapezoidal remains a longer time distinct from the great bone. Nevertheless no bone has a perfect resemblance, and on comparison the difference will be detected, although it cannot be expressed in words.

The differences of the *femora* are also very difficult to be expressed verbally. The head is more elevated and more convex towards the upper part than that of any ruminant. The great trochanter is wider and a little notched; the projecting ridge which goes from one to the other trochanter is more rounded; the internal edge of the rotular pulley ascends less than the other, which is the contrary of the structure in the ruminants; the notch between the condyles is narrower and pointed forward, &c. The tibia is easily recognised, because it is shorter, has its lower head squared and not narrowed from behind forwards, and has no articulation with the *fibula*. The principal difference of the *tarsus* rests on the small wedge-shaped bone, on the vestige of the fifth toe, and in the scaphoid remaining distinct from the cuboid bone. The astragalus tends to that of the ruminants by the form of the pulley of its lower head. The metacarpal bones, metatarsals, and toes cannot be confounded with those of any other animal, and their characters, partially visible externally, are known to all naturalists, or will be easily divined by them. It need only be remarked, that in the Peccary the two middle bones of the metacarpus and metatarsus are soldered into a *cannon*, as in the ruminants, and that the only vestige in this animal of the external toe on the hind foot is a small flattened stylet, applied against the base of the cannon bone.

The cervical vertebræ of the hog are not easily confounded with those of any ruminant of its proportions, by reason of the brevity of their bodies, and the width of their transverse apophyses, especially of those of the penultimate one. The body of the vertebra is not so convex in front as in the ruminants. (*Ossemens Fossiles.*)

In the *Proceedings of the Zoological Society of London* for 1837, is an interesting notice, by T. C. Eyton, Esq., of some osteological peculiarities in different skeletons of the genus *Sus*. The animals observed were, a male pig of the pure Chinese breed, brought over by Lord Northampton; a female pig from Africa, procured from Sir Rowland Hill, bart., M.P.; and an English male of the long-legged sort. Upon examining the first, Mr. Eyton was surprised to find that a great difference existed in the number of the vertebræ from that given in the *Leçons d'Anatomie Comparée* (vol. i., ed. 1835, p. 182), under the head either of *Sanglier* or *Cochon Domestique*. He also found that the other varieties differed, and he gives the following table of those differences:—

	English Male.	African Male.	Chinese Male.	'Leçons d'Anat. Comp.' Sanglier.	Cochon Domestique.
Cerv. . .	7	7	7	7	7
Dors. . .	15	13	15	14	14
Lumb. . .	6	6	4	5	5
Sacr. . .	5	5	4	4	4
Caud. . .	21	13	19	20	23
Total .	55	44	49	50	53

But he adds that it is possible that some of the caudal vertebræ may be missing.

Mr. Eyton further remarks, that the Chinese Pig was imported into this country for the purpose of improving our native sorts, with which it breeds freely, and the offspring are again fruitful. He adds, that he had seen a fine litter of pigs by Sir Rowland Hill's African Boar, imported with the female he described, the mother of which was a common pig; and he remarks, that time will show whether they will again be fruitful.

'From what has been stated,' says Mr. Eyton, in conclusion, 'the result appears to me to be, that either the above three *Pigs* must be considered as distinct species, and which, should the offspring of the two latter again produce young, would do away with the theory of Hunter, that the young of two distinct species are not fruitful, or we cannot consider osteological character a criterion of species.

'I have been induced to offer the above, not with any desire of species-making, but of adding something towards the number of recorded facts by which the question, what is a *species?* must be answered.'

Undoubtedly all such records are valuable; and the zoological labours of Mr. Eyton (especially in the department of ornithology) are too well known to require our humble praise. But there seem to us a little more point and haste in the above conclusion than are quite consistent with soundness. John Hunter's theories are not so easily done away with, and osteological character will, we venture to predict, continue to be considered a criterion of species, notwithstanding the differences here set forth. By the term *Pig* we understand the African and Chinese varieties of the Hog. *Phacochœrus* cannot be meant, or it would have been stated. The pure Chinese breed was imported long ago, and for years its stock, bred from its union with our English varieties, has been known in our farm-yards. The varieties bred by man from the Wild Hog are spread all over the world in a domesticated state; and there is no more reason to doubt that the result of the union of an African pig with a Hampshire hog would be fruitful, than that a breed composed of the Berkshire, Chinese, and Neapolitan would produce a good litter. Now if we take little or no note of the differences in the caudal vertebræ, for the reason assigned by Mr. Eyton among others, what remain? Differences not exceeding two in the dorsal vertebræ, two in the lumbar vertebræ, and one in the sacral vertebræ, after a course of domestication, no one knows how long. We know what breeding will do with dogs; take a greyhound and a true shepherd's dog for example—to say nothing of tailless cats:—we know what it will do among poultry; it will take away the drooping feathers of the cock's tail in those Bantams known to bird-fanciers as hen-cocks (Sir J. Sebright's breed), and remove the tail-feathers altogether (Rumpless fowls); whilst in the topknotted varieties an osteological difference is produced in the cranium. Man has occasionally an additional lumbar vertebra. This accidental excess was first detected in the negro, and was laid hold of by those who would have made him a different species; but, by and by, they found a white man with one more vertebra than he ought to have had, and wisely said no more about it.

There is nothing in the other parts of the internal orga-

nization of the *Suidæ* requiring particular notice; except perhaps the Stomach. Nos. 548 to 551 (both inclusive) of the Physiological Series of the Museum of the Royal College of Surgeons in London are preparations of the stomachs of Hogs; and Nos. 551 A to 553 (also both inclusive) are preparations of the stomachs of Peccaries. We would particularly call attention to No. 551 A, which exhibits the stomach of *Dicotyles torquatus*, showing this singular viscus divided into three compartments by the production of the two ridges, which are situated one to the left and the other to the right of the cardiac orifices, analogous to those in the stomach of the Hog. The cardiac, or left division, is greatly extended in the transverse direction, and terminates in two moderately elongated culs-de-sac. This division communicates with the middle compartment by a broad circular aperture. The œsophagus opens into the middle compartment, which is of less extent than the preceding, and communicates by a smaller transverse aperture with the pyloric division. The whole of the middle compartment is lined with cuticle, continued from the œsophagus. The left and right divisions, being laid open, show the extent to which the cuticle is prolonged into them. The greater part of the cardiac cavity, with the two culs-de-sac, being lined by a villous membrane, proves that it has a greater share in the digestive processes than as a mere preparatory receptacle. The villous coat of the pyloric cavity is remarkably thick, and the muscular coat is considerably increased near the pylorus, the valvular structure of which is better seen in No. 551. (Owen in *Cat. Mus. Coll. Reg. Chir.*, vol. i.)

Systematic Arrangement and Natural History.

Linnæus placed the genus *Sus* between Hippopotamus [River-Horse] and Rhinoceros, in his order *Belluæ*, which order stands between those of *Pecora* and *Cete*, in his last edition of the *Systema Naturæ*.

Cuvier arranges the *Cochons* (*Sus*, Linn.) under his ordinary Pachydermata. This genus comprises the subgenera *Sus*, *Phacochœrus*, and *Dicotyles*, and stands between *Hippopotamus* and Anoplotherium, which last is followed by *Rhinoceros*.

Illiger arranges *Sus* as the only genus of his *Setigera*, his last family of his fifth order *Multungula*, which order is immediately preceded by the *Nasuta*, consisting of the genus *Tapirus*. The *Solidungula* immediately follow the *Multungula*.

Mr. Swainson divides the *Ungulata* (Hoofed quadrupeds) into two tribes: 1. *Pachydermes*; 2. *Anoplotheres*. He places *Sus*, *Phacochœrus*, and *Dicotyles* in the second tribe, in company with *Tapirus*, *Palæotherium*, *Lophiodon*, and *Anoplotherium*, with *Xiphodon* and *Dichobunes* (*Dichobune*), as the subgenera of the last. [Anoplotherium; Palæotherium.]

European Suidæ.

All zoologists seem to agree that the domesticated hogs are the descendants of the wild boar, *Sus Scrofa*, Linn.; *Sus Aper*, Briss.; *Le Sanglier* of the French, still an inhabitant of many of the temperate parts of Europe and Asia, but no longer existing in a natural state in the British Islands.

Dental formula:—Incisors $\frac{6}{6}$; canines $\frac{1-1}{1-1}$; molars $\frac{7-7}{7-7} = 44$. (See the cut, p. 243.)

The wild boar, which is too well known to need description, and of which living individuals are often to be found in our menageries (where by the way they are styed up on a floor of flagstones, instead of being allowed small paddocks and access to water, where they might turn up the ground, wallow, and live in something approaching to comfort), harbours in the most solitary places in retired forests. His lair is generally in some wild and remote spot, not far from water, and commanding by some devious path access to the open country. The young, or *marcassins*, as they are termed by the French, are striped with longitudinal bands.

Throughout Europe the boar was held in high estimation as a beast of chace. Nobles, princes, and even kings delighted to take the field with the boar-spear, and peril their persons in hunting this fierce animal. In our own country, where it formerly rioted in the dense forests which have now vanished before the inroads of an increasing population, the loss of his eyes* was the punishment inflicted by William the Conqueror on him who was convicted of killing a wild boar. In the vast forest which so late as Henry II.'s time stood on the north side of London, were stags, fallow-deer, wild boars, and bulls. In the *Leges Wallicæ* it appears that Howel-dda gave permission to his grand huntsman to chace the boar from the middle of November to the beginning of December. In Europe the boar-spear has given way to the rifle; but in India, where the field is taken on horseback, the spear is still used, and hog-hunting appears to be one of the most exciting of the wild sports of that land of the sun.

An attempt was made by Charles I. to restore this noble game to England; and he turned out several wild boars in the New Forest: but the civil wars were no friendly times for the experiment, and they were all destroyed. More recently General Howe procured some wild boars and sows from Germany, and turned them into the forests of Walmer and Alice Holt or Ayles Holt, 'to the great terror of the neighbourhood,' as White says, in his 'History of Selborne;' 'and, at one time, a wild bull or buffalo: but the country rose upon them and destroyed them.'

We can see no reason why the boar should not be introduced into some of our royal forests at least. It would not be more dangerous than the stag or the deer; and unharbouring the boar, with all the accompaniments of the spear and the couteau, and the grand boar-hounds, such as we see in the pictures of Snyders, would be sport-worthy of a prince.

The different domestic breeds, and the economical part of the subject, are treated of in the article Hog. But, according to Pennant, this animal has been made useful to man even during its life. 'It has been applied,' says that author, 'to an use in this island, which seems peculiar to Minorca and the part of Murray which lies between the Spey and Elgin. It has been there converted into a beast of draught; for I have been assured by a minister of that country, eye-witness to the fact, that he had, on his first coming into his parish, seen a cow, a sow, and two *Trogues* (young horses) yoked together, and drawing a plough in a light sandy soil; and that the sow was the best drawer of the four. In Minorca the ass and the hog are common helpmates, and are yoked together in order to turn up the land.'

The senses of the hog are acute, especially that of smelling. The broad snout ploughs up the herbage; and not a root, an insect, or a worm escapes the olfactory sense. If fairly treated, it is by no means a dirty animal; but it is too often styed up in its own filth. There are few more pleasing scenes in the farm-yard than a well laid-out piggery properly kept. The animal itself is anything but stupid, and is capable of strong attachment where kindness is shown to it. That it is docile the number of learned pigs proves; and still more the famous sporting sow, that went regularly out with the gun, and stood her game as staunch as any pointer. It is said that the hog is trained on the Continent to hunt for truffles.

Asiatic Suidæ.

Genus *Babyrussa*, F. Cuv.—M. F. Cuvier has separated this form from *Sus*, relying upon characters, one of the principal of which is the upward direction of the alveolus of the upper canine tooth, which is enormously developed, ascending upwards, and curving back upon itself; the first upper grinding tooth is a false molar, and the two first below have the same character. The canines of the lower jaw form long, and, as compared with the other tusked *Suidæ*, slender tusks, as the animal advances in age.

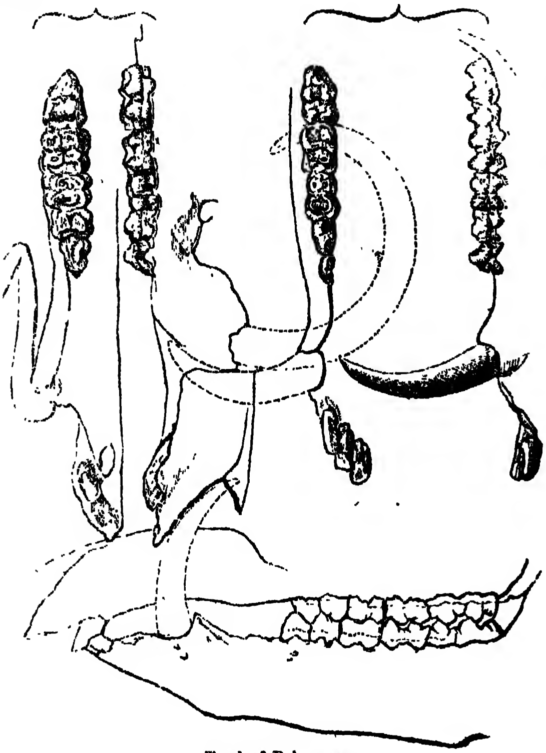
Dental formula:—incisors $\frac{4}{4}$; canines $\frac{1-1}{1-1}$; molars $\frac{5-5}{5-5} = 34$.

There is but one species of *Baby-roussa* (literally Hog-deer) or *Babiroussa*, as it is frequently written. This is the *Babyrussa alfurus* of modern authors, *Sus Babyrussa* of Linnæus, *Le Babyroussa* of Buffon, *Le Sanglier des Indes Orientales* of Brisson, and *Le Cochon Cerf* of Lesson and other French authors.

Description.—The Babiroussa stands high upon its rather slender legs. The skin, which is of a greyish tint, inclining to fawn-colour on the belly, is very thinly furnished with hair. The upper tusks come through the skin of the muzzle, and form nearly a circle directed backwards, often touch-

* The same penalty is said to have been inflicted on those who killed the stag or the roebuck.

ing the skin again on their downward curvature. The females are smaller than the males, and are without these tusks.



Teeth of Babyrussa.

Piso, in his edition of the 'Natural and Medical History of East India,' by Bontius, remarks, that sedulous as Bontius was, he had made no mention of this animal. Piso however supplies the deficiency, and gives in the page no very bad figures of the animal and of its skull. In the frontispiece however, where the Babiroussa occupies a conspicuous place in the foreground, the painter has evidently had the hog-*deer* in his mind, and has taken a few liberties with the animal's muzzle, aspect, and bearing, though the tusks are tolerably correct, lengthening its neck not a little. The Indians, Piso tells us, ascribe these animals to a union of the hog and the deer. He says that they are only found in the island of Bouro, thirty miles distant from Amboyna. He adds, that the Babiroussa is swift and fierce, and that its flesh is highly prized (inter delicias expetita) by both natives and foreigners.

It still inhabits the marshy forests of the island of Bourou, and is said to be abundant in the Moluccas, and a few other islands of the Indian Archipelago.

M. F. Cuvier has given very good figures, and a lively description of two males and females brought to France in the Astrolabe, and kept in the Paris Menagerie. The female was much younger and more active than the male, which was aged and very fat, and spent his short life in eating, drinking, and sleeping. The female bred once after her arrival in Europe. When the male retired to rest she would cover him completely over with litter, and then creep in under the straw to him, so that both were concealed from sight. They died of diseased lungs about three years after their arrival.

M. Lesson states that in captivity the Babiroussa is restless and fierce, a character which is certainly not deserved by the young male exhibited in the garden of the Zoological Society in the Regent's Park, which appears inclined to be familiar, and likes to be noticed. This individual gets under the straw in the manner described by F. Cuvier. Indian corn seems to be a favourite food in confinement.

The lower tusks must be formidable weapons, though not so destructive as those of some of the other *Suidæ*. In old individuals the upper tusks can hardly inflict a wound: they may perhaps ward off the bushes from the eyes of the animal as it rushes through the thick cover of its retreats.

Here we may notice the species figured and described by MM. Lesson and Garnot, in the *Zoologie de la Coquille*, under the name of *Sus Papuensis*

Babiroussa (male; from the individual in the garden of the Zoological Society of London)

Head of Babiroussa, seen in profile: *a*, male; *b*, female.

This new species, the *Bène* of the natives of New Guinea, is described as being remarkable for its small stature and its agreeable and slender form. The canines of the upper jaw are very small, and nearly of the same form as the incisors; the bristles are rather thick, short, yellow, and brownish below, white above and annulated with black: the tail is very short. The young (marcassins) are of a brown colour more or less deep, with five rather bright fulvous stripes upon the back.

The length of the Papuan Hog is three feet. It is common in the forests of New Guinea, and the Papuans highly esteem its flesh, which the French found excellent. The natives catch the young in the woods in order to rear them in a kind of domestication.

M. Lesson remarks that the *Sus Papuensis* has many points of analogy with the *Peccaries*, and seems to be intermediate between them and the true Hogs. The individual described by M. Lesson had only thirty-six teeth; perhaps, he observes, four molars were still to be developed, which would raise the number to forty.

African Suidæ.

Genus *Phacochœrus*, or, as it is written by some, *Phascochœrus*, F. Cuv.

Generic Character.—Feet formed like those of the true Hogs; two triquetrous incisors above, six small ones below; tusks lateral and directed upwards, very large; molars composed of enamelled cylinders enclosing the osseous substance and joined together by a cortical substance; very large fleshy warts or wens on the cheeks; tail short.

Dental Formula:—Incisors $\frac{2 \text{ or } 0}{6 \text{ or } 0}$; canines $\frac{1-1}{1-1}$; molars $\frac{3-3}{3-3}$; $=16$ or 24.

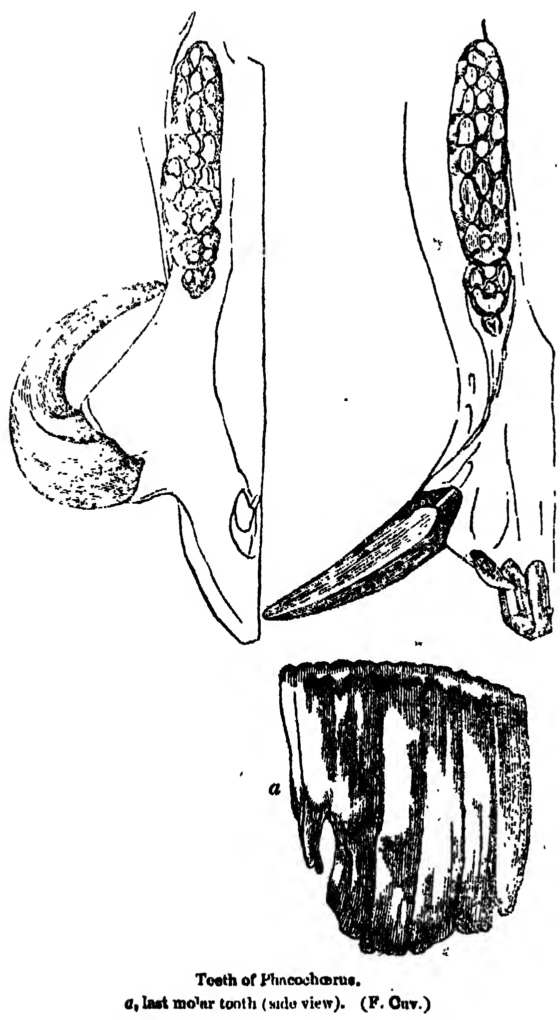
M. F. Cuvier remarks that we have here arrived at a system of dentition entirely different from that of the true hogs (Sangliers), and which announces animals endowed with a particular nature, and much more herbivorous than omnivorous. Nevertheless, in the locomotive organs the true hogs and the Phacochœres bear the greatest resemblance to each other, and have accordingly been united in the same genus, as far as these organs served for the principal basis of the formation of generic groups. At present, he observes, but two Phacochœres are known,* and one has incisors, whilst the other appears to be deprived of them. We have seen, he remarks, that in the Pachyderms there is but little regularity in the number of the teeth; and he inquires whether this may belong to the nature of these animals, or to lacunæ which it has not been given to us to fill up; a question which he will not decide. Therefore he does not separate these animals.

In the upper jaw the incisor is described by M. F. Cuvier as hooked, and very distant at its root from its congener, but as approaching it at its crown. The canine is a powerful

* A third species is now recognised; and, we believe, all three are in the British Museum.

tusk, the alveolus of which is open on the sides of the maxillary bone, and which develops itself, ascending and curving backwards, terminating in a sharp point. The first and second molars are, especially when compared with the third, very small teeth: they are composed of four tubercles, which, by use, present four small, elliptical, or circular figures, surrounded by enamel. The second is larger than the first. The great molar, the last, occupies a space twice as large as that which precedes it, and is composed of three rows of tubercles disposed longitudinally. Those on the edges are placed opposite to each other, and those in the middle are intermediate to the first. When these tubercles begin to be worn, they present so many disks of enamel, and form, as it were, three chains of rings; and when the effects of mastication extend further, these disks and these rings enlarge, and become more or less deformed: those on one side unite to those on the other, whilst those in the middle sometimes subsist; whence result some varieties of figure, in which, nevertheless, are ordinarily found indications of the first; and it is always anteriorly that these teeth are first worn, because there they first begin to rise from the alveolus, pushing before them the first molars, which often are found in great measure destroyed in old individuals, and have even, sometimes, entirely disappeared. These teeth are a very long time without taking root; it is only when they cease to push forward, which does not happen till very late, that they terminate in more or less elongated cones, in enveloping at their base the dentary capsule, which then divides and ceases to form a single organ.

In the lower jaw, we are told by the same excellent zoologist, the two first incisors are of nearly equal size, and strongly levelled forwards; the third, which is very short, leans entirely against the two first. The canine is a strong triangular tusk, which departs much from the axis of the jaws. The molars do not differ essentially from those which we have described; only the first differs much more from the second in size than we have above seen.



Teeth of Phacochœrus.
a, last molar tooth (side view). (F. Cuv.)

In their reciprocal position, adds M. F. Cuvier, the two first lower incisors are in relation with the upper one. The third below is only opposed to the gum. The canine, by its postero-internal surface, is united to the antero-external surface of the upper canine; and these tusks are sharpened by whetting. The molars are opposed crown to crown (*Dents des Mammifères.*)

M. Cuvier's plate is taken, as far as regards the upper jaw, from a Phacochœre without incisors, and, as relates to the lower jaw, from a Phacochœre furnished with those teeth; and he remarks that the disks of the last molars of the first are smaller and less numerous than those of the last molar of the second: he concludes by inquiring whether this may be a specific character.

Le Vaillant, in his 'Second Voyage dans l'Intérieur de l'Afrique,' states that in one of his huntings he killed a monstrous boar, absolutely different from all known hogs. Instead of the usual snout, it had that part very wide and square. The eyes were very small, separated very little from each other, and high on the forehead. On each side upon the cheek, a cartilaginous and very thick skin, three inches in length and width, elevated itself horizontally. At the first glance, he observes, one is apt to take those excrescences for the ears of the animal; and the more so, because these last organs, which are applied against the very short neck, are partially hidden in an enormous mane, the rusty, brown, and greyish bristles of which are sixteen inches long upon the shoulders. Directly below these false ears may be remarked on each side a bony protuberance projecting more than an inch, which serves the animal for striking right and left. It has, besides, four tusks, of the nature of ivory, two in each jaw; the upper ones, from seven to eight inches long, are very thick at their origin, and terminate in an obtuse point; they are furrowed, and rise into the air from the lips: those of the lower jaw are much smaller, and so applied against the great ones, when the mouth is shut, that one would take them, then, together as being only one and the same. The head of this boar, says Le Vaillant, is truly hideous; and, at the first view, one finds striking analogies and resemblances to the hippopotamus, which is hardly less frightful. He cautions methodists, who are accustomed to view nature only according to rules which they have established, against seeing a mere hog (Sanglier) in this animal: for, besides its large snout, it wants incisors in both jaws. Notwithstanding its wide-spread muzzle, it turns up the earth to seek for roots, on which it feeds. It is, he adds, very fleet, though very stout and large, and goes so fast that the Hottentots call it 'the runner.' Le Vaillant gives a figure of a young animal of this species, from one in his own cabinet, and states that the figure given in Buffon's Supplement of this boar of the Cape has little exactness, nor can one at all recognise the head of this creature, the whole of whose characters have been neglected by the draftsman.

We illustrate this genus by Rüppell's *Phacochœrus Æliani*, or *Ælian's Wart-Hog*, from the north of Africa.

After stating that the discovery of two species of this genus is due to F. Cuvier, it is remarked that in all the individuals of *Phacochœrus Æliani*, whether old or young, of both sexes, there were in the intermaxillary bone two incisors, with their crowns turned inwards, and their roo directed outwards, wedged into the lower plate of that bone. These upper incisors were of greater size in males than in females, generally larger in animals that had obtained their full growth than in younger ones, and, in general, they rose freely a few lines above the axis of the palate. In the lower jaw were six incisors, which were not wanting even in very old animals, in which last they were invariably larger than in the young ones. The upper canine teeth had on their outer and inner surface a groove, which was continued with the curve; but this groove was wanting in the lower canines, which were one-third smaller in old animals than the upper ones. In all, young and old, of both sexes, there were four back teeth in the upper jaw, and three in the lower jaw. The first and second were small, narrow, somewhat round, with simple crowns, and with two roots wedged into two separate sockets. The third in the upper jaw and the second in the lower were strong, and as broad as the fourth: its enamel-surface consisted of five crown-globules, four in each corner, and one in the middle. It had four roots, wedged into four separate alveoli.

With regard to the three first back teeth, it is remarked that, as age adv ces, they gradually disappear, and none

but the anterior ones remain. In a very old animal all three were almost entirely destroyed. The third was diminished by two-thirds, and nothing remained of it but the crown-surface, which kept its position solely from being wedged in between the fourth large one and the second: the alveoli that had been occupied by its roots had entirely vanished. But even in this animal all the upper and lower incisors still remained, although very much worn. After admitting the soundness of F. Cuvier's views as to the loss of the anterior molars by the pushing forward of the fourth, attention is called to the twofold type in the construction of the molar teeth of the wart-hog, and to the diversity of their growth. The three anterior molars are shaped like other molar teeth, are nourished in the same manner, have enamelled crowns and true roots. These must decay and die when they have attained their utmost growth. The alveoli then fill up with bony substance, loosen, and finally push out the teeth they contained. The three anterior teeth then decay and fall out, like the teeth of all other animals advanced in age; but it is altogether different with respect to the fourth, the largest and hindmost molar. The latter is, as F. Cuvier has observed, a compound tooth, and to be classed with the teeth of the elephant.

The lower jaw contains only three molars. The two anterior formed, like the upper ones, with two and four roots: what has been said with regard to the posterior or fourth tooth of the upper jaw is quite applicable to the third or last of the lower jaw.

Phacochœrus Æliani, then, is at all ages provided with incisors in the upper and lower jaw, and therefore is in the most marked manner distinguished from the wart-hog of the Cape. Another distinction is, that the Cape wart-hog has, according to F. Cuvier, only three molars in the upper and lower jaw; whereas *Phacochœrus Æliani* always presents four in the upper jaw. But there is hesitation in admitting this last mark of distinction to be of much weight, because the anterior molars are disposed to decay.

Further, if a line be drawn from the hind part of the head, as far as the most prominent part of the nasal-bone, there will be found in *Phacochœrus Æliani* a sinus, the depression of which falls in the middle of the line. This very place, in the case of the wart-hog of the Cape, rises to an arched prominence; and there are other differences.

Description of Phacochœrus Æliani.—Skin of an earthy colour, scantily bristled. A mane which extends along the neck and the back arises between the ears: the single hairs of it are frequently ten inches long. All the bristles, those of the mane included, are light brown. They have not each a several root, but three or six bristles form one tuft, and have one common root. The whole body, with the exception of the back, appears rather bare. The head is broad along the brow, which is rather depressed; the eyes are small, and situated very high up; there is a depression below the eyes, and near the cheek is a wart, which, as compared with a smaller one alongside the cheek, may be called the larger wart. These warts are formed of thickened skinny tissue, and they are smaller than in the species from the Cape. A whisker of white hair curling upwards runs along the lower edge of the lower jaw. The eyes are small, eye-lashes blackish, eye-brow bristles long and black, and under the eyes is a tuft of bristles. Ears cut obliquely at the lower part of the external edge, and the whole margin bordered with white bristly hair. Tail nearly bare, thin,

Phacochœrus Æliani (Rüppell).

and with a tuft of hair. On the fore-feet a piece of thick hard protuberant skin.

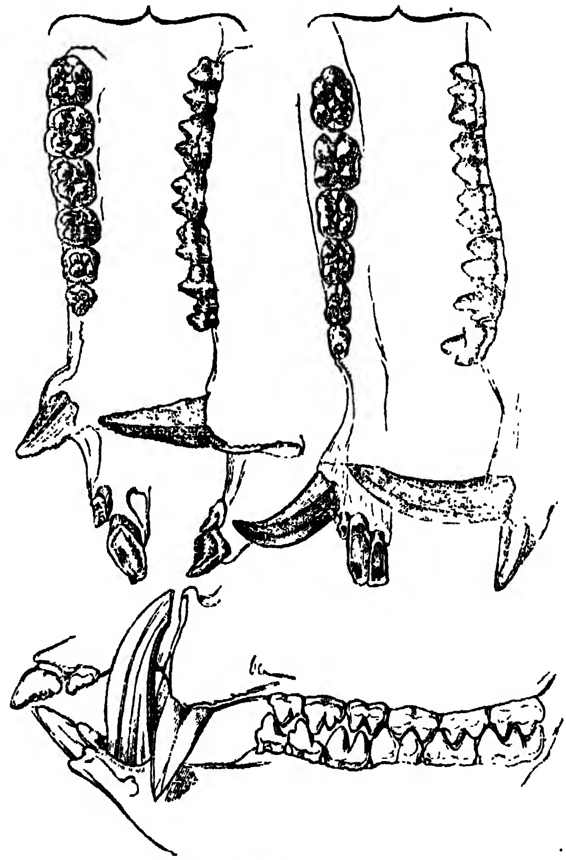
Locality, Habits, &c.—This species was found by M. Rüppell, first in Kordofan, and more frequently afterwards on the eastern slope of Abyssinia. It haunts low bushes and forests. It creeps on its bent fore-feet in quest of food, and in this posture digs up the roots of plants (of which its food is supposed to consist) with its enormous canine teeth. The hind-legs push the body forward as it moves in this posture.

American Suidæ.

Genus *Dicotyles*, Cuv.

Generic Character.—Intermediate toes larger than in *Sus*, and touching the ground. Canines of the ordinary form, not protruding from the mouth. Incisors and molars resembling those of *Sus*. A glandular opening on the loins, secreting a fetid humour. No tail. The two great bones of the metacarpus and those of the metatarsus united together.

Dental Formula:—Incisors $\frac{4}{6}$; canines $\frac{1-1}{1-1}$; molars $\frac{6-6}{6-6}$; = 38.



Teeth of Dicotyles. (F. Cuv.)

Cuvier remarks, that the Peccaries want the external toe on the hind feet, and the tail. The bones of the metatarsus and metacarpus of their two principal toes are soldered together into a species of *cannon*, as in the ruminants, with which their stomach (*ante*, p. 245), divided into many compartments, gives them a marked relationship. He further observes, that it is singular that their aorta is often found very much *puffed out* (renflée), but without any fixed place for the swelling, as if they were subject to a sort of aneurism. ('Tyson found this to be the case in his specimen, but I have searched for it in vain in the specimens that have died at the Gardens.'—R. O.)

Of this form, now so well known by means of our zoological societies and publications, there are two species, *Dicotyles torquatus* and *Dicotyles labiatus*.

Dicotyles torquatus.—In Hernandez we find a figure and two descriptions of this species, under the names of *Quauhtla Coymatl, Quapizotl, Aper Mexicanus*, by which 'Jo. Fabri Lyncei descriptio' is headed; and of *Coyametl*,

or *Quauhcoyametl*, 'quoniam est montanus,' by Fernandez. Both notice the gland on the loins; and the latter, who repeats the Mexican names first above stated, remarks that it is fierce and truculent when first taken, but mild when tamed, 'et amicus domesticis, haboturque in deliciis.' The flesh he describes as similar to ordinary pork; but harder and not so sweet, and the food of the animal as consisting of acorns, roots, 'and other mountain fruits,' as well as of worms, earthworms, and other creatures of the same sort that are bred in lacustrine, moist, and marshy places. These Mexican Hogs, he adds, lay waste the cultivated fields, if they are not driven from them, go in droves, and when domesticated are fed on the same esculents as the common hogs.

Piso, whose figure is not so good as that in Hernandez, describes this species, under the name of *Taiaçu*, as a wild pig, but yielding in size and fierceness to the boar, and scarcely acquiring the size of domestic hogs. He speaks well of its flesh: 'Admodum probatæ est carnis, ut facile nostratium domesticorum superet: lardo est tenuiori atque bono;' and also alludes to the gland, combating the notions that it was an umbilicus or a mammary organ. In many regions of America, especially in New Spain, many boars of this nature and conformation are, he tells us, found, and their flesh is equally approved of: that it may keep the better, the gland, he remarks, ought to be removed as soon as the animal is killed, otherwise it soon becomes corrupt. He characterises these Peccaries as irascible and revengeful; for, when they are wounded, they call together an infinite number of their kind, that they may attack their enemies, whether hunters or tigers, against which they exercise a perpetual enmity; so that it not rarely happens that the most sagacious hunters are obliged to save themselves by ascending a tree, when the leader of the herd, raging with his legions, bites and tears the trunk of the tree in lieu of the lost enemy. The hunters, surrounded by these irritated numbers, slay them in safety with hunting-spears or fire-arms; but it is long before the Peccaries break up, and not before they are tired out with watching and hunger.

These descriptions may apply to the *Collared Peccary*, *Dicotyles torquatus*, Cuv.; but we shall presently see that the other species, *Dicotyles labiatus*, Cuv., show their hostility to their enemies in the same way; and the descriptions probably refer to both.

The *Collared Peccary* has been bred in a state of domestication in South America and in some of the West India Islands: but, notwithstanding the favourable accounts given of its flesh by the author whom we have last quoted, it is out of all comparison inferior to that of the common hog, both in flavour and fatness. The comparative infertility, too, of the *Peccary*, which only produces two young at a birth, is at once a bar to its superseding the domestic pig, which is equally fertile in all climates where it has been introduced. The gland, too, is highly objectionable, making the animal, neat and trim as it generally is, a nuisance in life, and flavouring the flesh, unless removed immediately after death. D'Azara however seems to have revelled in its scent as a perfume; and Tyson and others appear to have considered it agreeable enough. Those which we have seen in captivity have been positively offensive; and the Peccaries seem to have affected the olfactory organs of Buffon, Sonnini, and indeed all other modern authors, in the same disagreeable way. This species is the *Patira* of Sonnini, and the *Taytêtou* of D'Azara, according to Mr. Bennett.

Locality, Habits, &c.—Mexico and nearly the whole of South America, where they haunt the thickest and greatest forests, dwelling in hollows of trees or earths made by other animals. Not common in the vicinity of villages, to which they are bad neighbours, devastating the crops of maize, potatoes, sugar-canes, and manihot.

Dicotyles labiatus.—D'Azara appears to be the first who distinguished the two species of Peccaries, which are both confounded by Linnæus under the common name of *Sus Tajacu*. Indeed the old writers above quoted seem to have fallen into the same error; for it is very improbable that the collared peccary only was known when they wrote. Cuvier, who first gave the scientific specific names now used, states that *Dicotyles labiatus* is the *Taytêtou, Tajassou*, &c., as well as the *Tagnicati* of Azara. It is larger than the *Collared Peccary*, which is seldom more than three feet long, and rarely weighs more than fifty pounds; whereas the *White-lipped Peccary* (*Dic. labiatus*) often measures three feet and a half in length, and sometimes weighs a hundred pounds. The last-named species is thicker and stouter, the legs are shorter, and the snout, which is longer, has its termination more expanded. Its prevailing hue is brown, and the lips are white. 'In its colour,' says Mr. Bennett, who has given very good figures of both species in his 'Gardens and Menagerie of the Zoological Society,' from which work we quote, 'it has little of the greyish tinge which characterises the latter, the black hairs of the back and sides having only a few brownish rings, which are rather more thickly spread on the sides of the head beneath the ears. These organs are less remarkable than in the other species, in consequence partly of the greater length of the mane, which advances forwards between them, and is continued down the back towards the tail, the bristles of which it is composed being very thick and somewhat flattened. The whiskers consist of long, black, scattered bristles; and a few others of a similar description project just above the eyes. The whole of the under-lip, together with the sides of the mouth and the upper surface of the nose, are white. The legs and hoofs are black; and the latter are long and narrow, the posterior one of the hinder feet almost touching the ground. The tusks are longer and more visible externally than in the Patira. In the young animal the livery is more varied, being in some degree striped like that of the young wild boar of Europe; but these stripes are lost by degrees as the animal advances in age, and few traces of them remain after the first year.'

The secretion from the gland in this species has been said to be inodorous. This could not be said of the white-lipped Peccaries exhibited in the garden of the Zoological Society of London, though they were perhaps somewhat less offensive than the Collared Peccaries.

Locality, Habits, &c.—Mr. Bennett says (*loc. cit.*), 'unlike the former species, the white-lipped Peccaries congregate in numerous bands, sometimes amounting, it is said, to more than a thousand individuals of all ages. Thus united they frequently traverse extensive districts, the whole troop occupying an extent of a league in length, and directed in their march, if the accounts of the natives are to be credited, by a leader, who takes his station at the head of the foremost rank. Should they be impeded in their progress by a river, the chief stops for a moment, and then plunges boldly into the stream, and is followed by all the rest of the troop. The breadth of the river or the rapidity of the current appear to be but trifling obstacles in their way, and to be overcome with the greatest facility. On reaching the opposite bank, they proceed directly on their course, and continue their march even through the plantations which, unfortunately for the owners, may happen to lie in their way; and which they sometimes completely devastate by rooting in the ground for their favourite food, or devouring such fruit as they find there. If they meet with anything unusual on their way, they make a terrific clattering with their teeth, and stop and examine the object of their alarm. When they have ascertained that there is no danger, they continue their route without further delay; but if a huntsman should venture to attack them when they are thus assembled in large numbers, he is sure to be surrounded by multitudes, and torn to pieces by their tusks, if he is so unwise as to neglect his only chance of escape, which consists in climbing a tree, and thus getting fairly out of their reach. The smaller bands are by no means equally courageous, and always take to flight at the first attack.'

M. Lesson remarks that this species have been nowhere more particularly observed than in Paraguay.

In Guiana, Sonnini was often surrounded by a herd of Peccaries, exasperated at the havoc made among them by the fusils of himself and his companions. Betaking himself to a tree, he beheld at his ease how they encouraged, by their grunts and rubbing snouts together, those which were wounded from the shots above, still maintaining their ground with bristles erect and eyes fiery with rage. They sometimes stood an incessant *fusillade* of two or three hours before they quitted the battle-field and left their dead to the conquerors. After such encounters comes the festival of the travellers. A great gridiron, so to speak, of sticks fixed in the ground and some three feet in height, with numerous small branches laid on it in a transverse direction, is got ready. On this sylvan cooking-apparatus the pieces of Peccary pork are broiled over a slow fire kept up during the night. Sonnini dwells enthusiastically on these forest feasts, to which he looks back with regret.

FOSSIL SUIDÆ.

Fossil remains of this family have been found in the second division (Miocene of Lyell) and the third and fourth divisions (Pliocene of Lyell) of the tertiary deposits. In the first of those divisions are to be noticed the three species of *Sus* found in the Epplesheim sand. Bones of swine occur frequently in the bone caverns and bone breccia.

The following porcine remains are noticed by Herrmann von Meyer, in his *Palæologica*:—*Sus Scrofa, fossilis*, Cuv., from the bone caverns (Hutton Cave on Mendip for example) and the bone breccias: *Sus priscus*, Goldf., from the bone cave at Sundwick in Westphalia; *Sus* (*Aper*) *Arvensis*, Croiz. and Job., from the Puy-de-Dôme; *Sus antiquus*, and *Sus palæochœrus*, Kaup, from the Epplesheim sand; and remains of *Sus* (Bourdet) from the tertiary. (*Mém. de la Soc. Lin. de Paris*, iv.)

Here we may notice *Chœropotamus* [PACHYDERMATA], a fossil genus closely allied to *Sus*, and in some respects, especially in the dental details, approaching nearest to *Dicotyles*. The following species have been detected:—*Chœropotamus gypsorum*, Desm.; *Chœropotamus Parisiensis*, Von Meyer, from the gypsum at Montmartre (Cuv.); *Ch. Meissneri*, Von Meyer, from the Braunkohle, Switzerland; *Ch. Sömmeringii*, Von Meyer, from the tertiary (Lacusteikalk von Georgengmund); a *Chœropotamus?* detected by Clift from the banks of the Irawadi (*Geol. Trans.*, vol. ii., 2nd series), by Fischer (*Essai sur le Turquoise*), and by M. de Serres (*Ann. des Sci. Nat.*, ix.). See further Professor Owen's paper *On the Fossil Remains of Chœropotamus, Palæotherium, Anoplotherium, and Dichobunes, from the Eocene formation, Isle of Wight*, wherein the *Chœropotamus gypsorum* of Desm., *Ch. Parisiensis* of Von Meyer, is characterised, on more ample data than had hitherto occurred, as *Chœropotamus Cuvieri*. (*Geol. Trans.*, vol. vi., 2nd series.) [PALÆOTHERIUM, vol. xvii., p. 152.]

Professor Owen has also characterised, in the same volume of *Geol. Trans.*, a new form (*Hyracotherium*), whose skull was probably intermediate in character between that of the hog and the HYRAX, under the name of *Hyracotherium leporinum*, from the London clay at the æstuary of the Thames (Eocene of Lyell).

Dr. Lund remarks, that there are but two genera of *Pachydermata* at present belonging to Brazil, the Tapir and the Peccary. Among the immense quantity of bones referrible to the latter genus, he says he can make out at least four species, very distinct from each other, and equally so from the two recent species, one of the fossil species nearly doubling in size either of the recent.

For *Anthracotherium*, which may be perhaps looked for here, see PACHYDERMATA and Von Meyer's *Palæologica*.

SUIDAS (Σουΐδας), a Greek lexicographer. Strabo (p. 329, Casaub.) speaks of a Suidas who wrote an historical work on Thessaly, which is also cited by the scholiast on Apollonius Rhodius, and by Stephanus of Byzantium; but it seems very unlikely that this Suidas was the author of the Lexicon which goes under the name of Suidas. Eustathius, in his 'Commentary on Homer,' occasionally quotes Suidas the lexicographer; and as Eustathius lived about the end of the twelfth century A.D. and the beginning of the thirteenth, we may conclude that the lexicographer Suidas was at least prior to this time. There appears to be no certain indication in the Lexicon of Suidas which will show who he was or what was his country. There are indeed passages in the work from which it appears that he lived during or after the reign of Alexius Comnenus, for he quotes Michael Psellus (v. Γηώρας; v. Δέρτρου; v. Ἡγήτορες); and if these passages were inserted by Suidas, he must have lived not earlier than the close of the eleventh century A.D. (But see Gaisford's edition.) In the article 'Adam,' he gives a chronological epitome, which he closes with the death of the emperor John Zimisces, who died A.D. 974; and in another place (v. Κωνσταντινούπολις) he speaks of Basil II., and his brother Constantine, who succeeded John Zimisces. There are other passages in Suidas, from which some inferences as to his age might be derived, but it is often difficult to know when the lexicographer is quoting others or speaking himself. Whatever may be the age of the compiler of the Lexicon, the work has the appearance of having received additions from a variety of hands.

The work of Suidas is a Dictionary arranged alphabetically, but with some deviations from the strict alphabetical order. It contains both proper names, as names of persons and places, and words which belong to a dictionary of a language in the modern acceptation of that term. Among the names of persons there are names both from profane history and from sacred history, such as Abimelech and Adam. The work is exceedingly imperfect in all the classes of names, and appears to have been formed on no plan. Some of the articles are long and tolerably complete; others are very short and contain no information. Thus, for instance, 'Adam' is a long article, but of 'Aaron' we are told nothing more than that it is a proper name. The work is compiled from numerous writers, some of whom are mentioned in a list prefixed to the Lexicon, comprising twelve names, among which are Eudemus and Cassius Longinus. It may however be doubted if this list was made by the compiler of the Lexicon. A much more copious catalogue is contained in the edition of Küster. Among the old scholiasts, none was used by the compiler more freely than the scholiast on Aristophanes; but the work of Suidas contains some passages which are not in the extant scholia on Aristophanes. The work is not only deficient in plan, but is often defective and inaccurate in the execution. Numerous corrupt and base words have been introduced from bad authorities or bad manuscripts; sometimes under one name of a person we find events belonging to the lives of various persons of the same name, placed without any discrimination (v. Σεβῆρος); and under one name there are frequently events and extracts from writers which belong to other names (v. Μαλχῖνος; v. Ἀλυάττης; v. Πῶρος). The Lexicon contains a great number of extracts from Greek writers, and frequently without mention of their names, but these extracts have often no reference to the title of the article, and add nothing towards explaining or illustrating it. This is partly owing to many marginal additions having been introduced into the text by ignorant transcribers.

With all these defects the Lexicon of Suidas is a very useful work, and is of great assistance for the literary history of antiquity. It is also useful for illustrating the meanings of many words. It also contains numerous passages of antient writers that are lost. As to the biographical notices, it has been conjectured that they have all been taken from one work, which is further conjectured to be the 'Onomatologon' of Hesychius. The 'Onomatologon' was a list or catalogue of men distinguished for knowledge, and it is stated in the Lexicon (v. Ἡσύχιος) that it is an epitome of the work of Hesychius of Miletus, who lived in the time of the emperor Anastasius; but we may allow this assertion to have its full weight, without admitting that it is the only source from which Suidas derived even his literary notices. (See the notes of Küster, and Naeke.)

There is an unpublished epitome of Suidas by Thomas of Crete: Robert Grostete, bishop of Lincoln, who died in 1253, is said to have made a Latin translation of Suidas (Fabricius, *Bibl. Med. et Inf. Lat.*); but see the note in Fabricius (*Biblioth. Graeca*, vi. 402, ed. Harles).

The first edition of Suidas was by Demetrius Chalcondylas; it was printed at Milan, 1499, fol., without a translation. This edition is defective in some places. The second was the Aldine edition of Venice, 1514, fol., also without a translation: this edition differs in some passages from that of Chalcondylas, whence it seems probable that it was printed from a different manuscript. The edition of Aldus was reprinted by Froben, at Basel, 1544, fol.; also without a translation, but with the correction of some typographical errors. H. Wolf made the first Latin translation of Suidas, which was published at Basel, 1564, fol., without the Greek text, and the revised translation was printed again at Basel, 1584. The first edition of the Greek text with a Latin translation was by Aemilius Portus, Geneva, 1619, 2 vols. fol.: the Latin version was new. In 1705 the edition of Küster appeared at Cambridge, in 3 vols. folio, with the improved version of Portus and numerous notes. The foundation of this edition is the text of Portus, which was corrected with the help of MSS. The preface of Küster contains a dissertation on Suidas, and on the previous editions, and more particularly on that of Portus. The last edition of Suidas is by Gaisford, 3 vols. fol., Oxford, 1834; the first two volumes contain the text, and the third the indexes. Gaisford states in his preface that Küster used pretty nearly the same MSS. as himself, but that he has been very careless in noting the readings, and that his edition, though useful in other respects, is consequently of very little critical value. Gaisford has noted all the various readings of the best MSS., and also the readings of the

Milan edition. He has also generally noted the emendations of Portus, many of which Küster adopted without any remark; indeed Küster is accused, and justly, of taking the notes also of other scholars without any acknowledgment. Gaisford has carefully indicated the sources from which Suidas derived his information; and he has reprinted most of Küster's notes. The third volume of Gaisford contains the 'Index Küsterianus Rerum et Nominum Propriorum quae extra seriem suam in Suidae Lexico occurrunt,' and two new indexes. One of these two new indexes contains all the words in Suidas arranged in alphabetical order, which is useful because the Lexicon does not always follow the usual alphabetical order; and it also contains other words which do not appear in the alphabetical order of the Lexicon. The other of these two indexes is an index of the writers who are cited by Suidas. This edition is a splendid and valuable work.

Various critics have laboured on the text of Suidas, among whom Toup is perhaps the most conspicuous for acuteness and diligence.

(Fabricius, *Biblioth. Graeca*, vi. 389, ed. Harles; Ludolph Küsteri *Praefatio; Praefatio Editoris Oxoniensis.*)

SUISSET, R., lived about the middle of the fourteenth century, and was educated at the university of Oxford. He is principally known as the author of a work printed at Venice in 1505, and again in 1520; the latter edition, the only one we have met with, is entitled 'Subtilissimi Ricardi Suiseth Anglici Calculationes noviter emendatæ atque revisæ.' A complete analysis of a new philosophic theory developed in this work is given in Bruckeri (*Hist. Phil.*, tom. iii., p. 580-583). Among its contents may be particularly mentioned the chapters 'De intentione et remissione,' 'De loco elementi,' 'De maximo et minimo,' 'De luminosis,' 'De motu locali,' and 'De medio non resistente.' Pits mentions other works by this writer, which do not appear to have been preserved: Tanner altogether omits him. We have placed the initial only of his Christian name at the head of this article, because, although he is called Richard in the title of the work just given, yet the colophon of the very same book writes 'Calculationum Liber Magistri *Raymundi* Suiseth;' and a contemporary manuscript note in one of the two copies of the book in the British Museum corrects the former appellation to Roger; while Vossius (*De Scient. Mat.*, c. 18) calls him John Suiseth.

SUIT is a legal term used in different senses. The word *secta*, which is the Latin form, is from 'sequor,' to follow; and hence the general meaning of the word may be deduced.

1. A suit, in the sense of litigation, is a proceeding by which any legal or equitable right is pursued, or sought to be enforced in a court of justice. Where the remedy is sought in a court of law, the term suit is synonymous with action; but when the proceeding is in a court of equity, the term suit is alone used. The term is also applied to proceedings in the ecclesiastical and admiralty courts.

2. Suit of court, in the sense of an obligation to follow, that is, to attend, and to assist in constituting, a court, is either real or personal.

Suit-real, or rather suit-regal, is the obligation under which all the residents within a leet or town are bound, in respect of their allegiance as subjects, to attend the king's criminal court for the district, whether held before the king's officer and called the sheriff's tourn [TOURN], or held before the grantees of leets or the officers of such grantees, and called courts-leet. [LEET.]

Suit-personal is an obligation to attend the civil courts of the lord under whom the suitor holds lands or tenements; and this is either suit-service or suit-custom. If freehold lands, &c. be holden of the king immediately, or, as it is feudally termed, in chief, suit-service is performed by attendance at the county court, the court held by the king's officer, the sheriff, unless the lands, &c. constituted an entire barony, in which case the suit demandable from the tenant was, his attendance as a lord of parliament. If freehold lands, &c. are held mediately only of the king, but immediately (or in chief) of an inferior lord, the suit demandable is attendance at the court baron of the lord: in either case suit-service is expressly or impliedly reserved upon the creation of the tenure, as part of the services to be rendered for the estate. In manors [MANORS] where there are copyhold, that is, customary estates, the custom of the manor imposes upon the copyholder an obligation to attend the lord's customary court; but as this obligation is not annexed by tenure to the land held by the copyholder, but is annexed by custom to his position as tenant, the suit is not suit-service, but suit-custom. In the case of freeholders attending as suitors the county court or the court-baron (as in the case of the antient tenants per baroniam attending parliament), the suitors are the judges of the court both for law and for fact, and the sheriff or the under-sheriff in the county court, and the lord or his steward in the court-baron, are only presiding officers with no judicial authority. But in the criminal jurisdiction of the tourn and leet, the sheriff and the grantee of the leet, or his steward, are the judges; and the suitors act only a subordinate part.

In the customary court, though its functions are confined to matters of a civil nature, yet, on account of the original baseness of the copyhold tenure, the judicial power is wholly in the lord or his steward.

3. Besides suit of court, secta ad curiam, there are other species of personal suit, which, like suit of court, are divisible into suit-service and suit-custom. Of these the most usual is suit of mill, secta ad molendinum, which is where, by tenure or by custom, the freehold or customary tenant is bound to grind his corn at the lord's mill.

SUIT and SERVICE. [SUIT.]

SULETIELMA. [SWEDEN.]

SULEYMAN. [MOORS, p. 386; SOLIMAN, IBN AL HAKEM.]

SULI, a mountainous district of Southern Albania, which extends in length about 30 miles from north to south, and about 20 miles in breadth, and is separated to the south-west from the coast of the Adriatic by a strip of lowland in which is Port Fanari, the antient Elæa, at the mouth of the Acheron. On the south-east the highland of Suli is bounded by the plain of Arta, which extends to the gulf of the same name. Towards the north Suli borders on the district of Paramithia, and on that of Janina towards the north-east. The river Glyky, the antient Acheron, coming from the north, flows along a deep valley which intersects the highlands of Suli, and after being joined by several streams enters the Adriatic at Port Fanari. The district of Suli is part of the antient Thesprotia, one of the three great divisions of Epirus. It contains eighteen villages or hamlets, of which ten or eleven are in the highlands, and the rest in the plain at the foot of them. The principal village, called Mega Suli, and by the Turks Kako Suli, lies on a hill near the left bank of the Acheron; not far from it is the village of Kiapha, and higher up the mountain is that of Kuugi. In the plain, at the foot of the mountain, the principal village is called Securates. The whole population of Suli, at the time of the war with Ali Pasha, did not amount to more than 12,000, divided into about thirty tribes or clans, each consisting of several families related or allied to one another. The principal tribes were the Zavella, Botzari, Zerva, Pasati, and Drako. The head of each clan was styled captain, and led his contingent in war, subject to a supreme commander styled Polemarch, who was chosen by votes for the time. Their mode of fighting was that of partisans or skirmishers, and they were generally good marksmen.

The oral language of the Suliotes is the Albanian, but they use the modern Greek for their written language. They all belong to the Greek or Eastern church. Their appearance and costume resemble those of the Albanians, but their social habits and traditions are more like those of the Greek race. The mountains of Suli produce only pasture for cattle and timber-trees, but the plain is cultivated, and produces corn, pulse, and other provisions. The houses are rudely built, and the country is altogether poor; but the almost continual state of warfare in which the Suliotes lived towards their neighbours, before their total subjugation, gave them the means of supplying their wants.

Suli has become an historical name on account of its long struggle against the forces of Ali Pasha of Janina, at the end of the last and the beginning of the present century. The political condition of Epirus, or Southern Albania, previous to that epoch, was very peculiar. The country was divided into two pashalicks, Janina and Delvino; but several districts, such as Suli and Chimari, were independent communities, often at war with the pashas sent by the Porte, and at other times friendly, but not subject to them. Other districts, such as Gardiki, Paramithia, Argyrocastro, &c., inhabited both by Christians and Mussulmans, were under the rule of beys, a kind of feudal lords, tributary to the Porte, but often at variance with the pashas. Lastly, there were the Venetian possessions of Prevesa, Parga, and Bu

trintò, along the coast, supported by the Venetian garrison of the neighbouring island of Corfù, and protected by the Venetian navy, which acted indirectly as a check upon the arbitrary power of the pashas, affording a refuge to those who escaped from their tyranny, and also a market and a place of supply for the Christian population of Epirus. The whole maritime coast of Epirus was in a manner under the protection of Venice. By a treaty between the Porte and the Venetian senate, no Turkish armed ship was allowed to sail into the Adriatic, and the pashas of Epirus were even forbidden from constructing any battery within a mile of the coast.

In the war between Russia and the Porte (1787-92), the Suliotes were among the most active partisans of Russia, and Suli was the centre of the insurrection against the Ottomans, which broke out in various parts of Greece. Ibrahim Pasha of Avlona, and several beys of Epirus, favoured the insurgents. In 1789 Ali Pasha of Janina sent a considerable force against the Suliotes, who defeated it with great loss. In the following year, the Suliotes having joined with the Klephts of Pindus and other mountainous districts, ravaged Acarnania as far as the Achelous, without distinction of Greeks or Turks, and they afterwards overran the territory of Arta and Janina under the very eyes of Ali Pasha. The Suliotes also contributed men and money to the naval armament of the corsair Lambro Canzani, who scoured the Ægean Sea against the Turks. But the peace of 1792, between Russia and the Porte, left the insurgent Greeks and Epirotes exposed to the fearful vengeance of the Turks. Ali Pasha undertook to exterminate the Suliotes. He penetrated with a large force into their district, and took Mega Suli and Kiapha, but being desperately assailed by the people, who had retired to the mountains, under the direction of George Botzari, his troops were completely routed, and fled to Janina. Ali then concluded a peace or truce with Suli, which lasted a few years. Upon the partition of the Venetian states in 1797, when the French republicans occupied the Ionian Islands, Ali, affecting to be friendly towards his new neighbours, and, professing, like them, a great detestation of the old Venetian aristocracy, prevailed upon the French commander to overlook the old convention with Venice about closing the Adriatic, and to allow Turkish armed vessels to land troops near Butrintò, which surprised in the night the Christian populations of Nivizza and San Basilio, which had been till then under the protection of Venice. These populations were partly massacred and partly carried into slavery. War having shortly after broken out between France and the Porte, in consequence of the French invasion of Egypt, Ali Pasha took the opportunity of falling upon the French garrisons of Butrintò and Prevesa, and gained possession of those places. Parga alone preserved its independence, and remained the only ally of the Suliotes. [PARGA.]

In May, 1801, Ali Pasha began a war of extermination against Suli, and at last succeeded, as much by treachery and bribery as by an overwhelming force, in conquering that stubborn population. [ALI PASHA.] Many of the Suliotes fell in the struggle, others were murdered by Ali's soldiers, many of the women threw themselves into the river rather than fall into the hands of the Turks; and the rest of the population, about 4000, contrived to reach Parga, from whence they went to the Ionian Islands, then under the protection of Russia. A few, trusting to the promises of Veli Pasha, Ali's son, remained in their desolate villages. In the war for the independence of Greece, a body of Suliotes fought at Missolongi against the Turks, and they were for a time in the pay of Lord Byron.

(Ciampolini, *Le Guerre dei Sulliotti contro Ali Bascià di Jannina*, Florence, 1827; Hobhouse, *Travels in Albania*.)

SULLA is the cognomen of a branch of the Patrician gens Cornelia. This branch originally had the name of Rufus or Rufinus, which appears to have fallen into disuse, and to have given way to the new cognomen Sulla, which had the same meaning as Rufus, and was first borne by the Flamen Dialis.

1. PUBLIUS CORNELIUS SULLA (Gellius, i. 12, § 16), who was Praeter Urbanus, in 212 B.C., and, in accordance with an oracle of the Sibylline books, conducted the first celebration of the Ludi Apollinares. Hence he is said to have received the surname of Sibylla, which was subsequently contracted into Sylla or Sulla. (Macrob., *Sat.*, i. 17.) This account however is fabulous, for as Rufus and Sulla have the same meaning, it is more probable that the change of the one name for the other was only an arbitrary alteration. Plutarch (*Sulla*, 2) states that the dictator Sulla was the first who bore this surname, from which it is evident that Plutarch had read the memoirs of the dictator, or at least that part in which this point was explained, very carelessly.

2. P. CORNELIUS SULLA, a son of the former (1), was praetor in Sicily in the year B.C. 186. (Liv., xxxix. 6, 8.)

3. SERVIUS CORNELIUS SULLA, a brother of P. Cornelius Sulla (2). In the year 167 B.C. he was one of the ten Roman commissioners who, after the defeat of Perseus, were sent to Macedonia to arrange the affairs of that country. (Liv., xlv. 17.)

4. L. CORNELIUS SULLA, the father of the dictator Sulla, of whom nothing is known, except that he was not a man of any great property. (Plut., *Sulla*, 1.)

5. L. CORNELIUS SULLA FELIX, the son of L. Cornelius Sulla (4), was born in B.C. 138, in the consulship of P. Cornelius Scipio Nasica Serapio and D. Junius Brutus Gallaicus. When a young man he lived for a considerable time at Rome in lodgings, and in the same house with a freedman, which was looked upon as a proof of his limited means. But he appears nevertheless to have received an education as good as any of the illustrious young Romans of that time. (Sallust, *Jug.*, 95.) He indulged however in all kinds of debauchery; and women, actors, mimes, and buffoons were his favourite companions to the last years of his life. He appears to have been foremost among the fashionable young nobles of the time, and was always an especial favourite of the women. His stepmother loved him like her own son, and when she died he came into the possession of all her property. Nicopolis, one of his mistresses, who possessed considerable property, also bequeathed it all to him. His fortune being thus improved, he was enabled to enter into competition with others for the honours of the republic. In B.C. 107 he was appointed quaestor, and was sent with a detachment of horse to join the army of Marius, who was then carrying on the war against Jugurtha. The stern warrior was at first somewhat indignant that such an apparently effeminate young noble was sent to him as quaestor in such an important campaign. But Sulla, although he had hitherto appeared totally ignorant of military affairs, soon showed himself to be the most active and skilful officer in the Roman camp, and gained the confidence and admiration of Marius. He also possessed in the highest degree the art of winning the affection of his soldiers. (Sallust, *Jug.*, 96.) In the battle of Cirta, Sulla commanded the horse, and greatly contributed towards the victory over Jugurtha and Bocchus. (Sallust, *Jug.*, 101.) After this victory Bocchus began his treacherous negotiations with the Romans, and Marius sent Sulla and A. Manlius as ambassadors to the king. By his duplicity Sulla induced Bocchus to take a decided course, the consequence of which was that Jugurtha was treacherously delivered up into the hands of the Romans. (Sallust, *Jug.*, 102-113.) Sulla was so proud of having outdone the Numidian king, so famous for his cunning and prudence, that he had a seal-ring made, on which Bocchus was represented in the act of delivering Jugurtha into the hands of Sulla; and this seal he used to the end of his life. (Plut., *Sull.*, 3; Plin., *Hist. Nat.*, xxxvii. 4; Val. Max., viii. 14, 4.)

When Marius, in his second consulship (104 B.C.), undertook the war against the Cimbri and Teutones, he made Sulla his legate, who distinguished himself by making Copillus, a chieftain of the Tectosagi, his prisoner. The year following Sulla remained in the camp of Marius as tribunus militum, and again distinguished himself. But in the third year, 102 B.C., he left Marius and joined the army of Lutatius Catulus, the colleague of Marius, who was stationed with a force in the north of Italy. Plutarch ascribes this step of Sulla to the jealousy of Marius, who, he says, feared lest his own fame might be eclipsed by that of his tribune. But the real cause of this movement was in the actual state of things. Sulla must have been aware that in the army of Catulus, who, although a good man, was not an able general, his services would be much more useful; and that there was a much greater sphere of activity for his talents as an officer in the army of Catulus than in that of Marius. If there existed an ill-feeling at all, it is much more likely that the aristocratic Sulla felt indignant at a plebeian being elected consul uninterruptedly one year after the other. Sulla, while in the army of Catulus, was the soul of all under-

takings, and he made several successful expeditions against the Alpine tribes. On one occasion, when the army of Catulus began to suffer severely from want of provisions, Sulla contrived to obtain such plentiful supplies, that Catulus was enabled to send some to the army of Marius.

After the defeat of the Cimbri (101 B.C.) Sulla returned to Rome, where he resumed his old course of life. He did not come forward as a candidate for any public office until the year B.C. 94, when he was a candidate for the praetorship. But he was not elected, because the people, as he himself stated in his Memoirs, wished him first to hold the office of aedile, as they expected that on entering on the aedileship he would amuse them with magnificent games, and exhibit African beasts in the Circus, as it was known that he was a friend of Bocchus, who would easily procure for him rare and beautiful animals. (Plut., *Sull.*, 5.) In the year B.C. 93 however he gained his object by canvassing and bribing: he was made praetor urbanus (στρατηγία πολιτική, Plut.; comp. Aurel. Vict., *De Vir. Illustr.*, 75), and exhibited to the people the games which they had expected from his aedileship. (Plin., *Hist. Nat.*, viii. 20.) The year after his praetorship he went as propraetor to Cilicia with a commission to restore king Ariobarzanes to his kingdom of Cappadocia, from which he had been driven through the influence of Mithridates. This object was soon accomplished; and this bold and successful undertaking excited the attention of Arsaces, king of the Parthians, who, while Sulla was staying somewhere near the Euphrates, sent a messenger to him soliciting the friendship of the Roman people. The request was granted, though Sulla, who felt the honour of being the first Roman to whom such an application was made by a Parthian king, treated the ambassador with haughtiness and arrogance. In B.C. 91, when Sulla returned to Rome, Caius Censorinus brought against him the charge of repetundae, or malversation, in his office of propraetor, but did not follow it up. In this year the Marsic or Social War commenced, and for a time delayed the outbreak of the furious hostility between Marius and Sulla, which was kindled by apparently trivial circumstances. (Plut., *Sull.*, 6.) Both Marius and Sulla commanded separate divisions of the Roman army, and the latter distinguished himself much more than Marius, who perhaps already began to incline towards the cause of the Italians. In 89 Sulla was legate of the consul L. Cato, and destroyed the Campanian town of Stabiae. (Plin., *Hist. Nat.*, iii. 9.) He also defeated L. Cluentius near Pompeii, pursued him as far as Nola, and compelled the Hirpini to submit. In Samnium he surprised and routed the army of Motilus, and took Bovianum by storm after a siege of three hours. (Appian, *De Bell. Civ.*, i. 50.) During this war Sulla left nothing untried to gain the goodwill of the soldiers; and he even connived at their gross excesses. Thus when the soldiers beat to death with sticks his own legate Albinus, a man who had filled the office of praetor, Sulla not only did not punish this outrage, but rather boasted of it, saying that his men would fight all the better for it. (Plut., *Sull.*, 6.) When the time approached for electing the consuls for the year following, Sulla went to Rome to offer himself as a candidate. His successful campaigns had gained him such popularity, that he was almost unanimously elected consul for the year B.C. 88. (Vellei. Pat., ii. 17.) He was now in the forty-ninth year of his age. His colleague was Q. Pompeius Rufus, who obtained Italy as his province. Sulla had Asia and the command in the war against Mithridates. The Social War was still going on, and Marius was not only exasperated because his former quaestor was now his equal, but was at the same time anxious to get the command in the war against Mithridates, and with this view he persuaded the tribune P. Sulpicius to give him his assistance in depriving Sulla of the power intrusted to him. A direct attempt to this effect would have been imprudent. Marius and Sulpicius therefore first tried to gain the interest of the Italian allies, and to identify the popular cause, represented by Marius, with that of the allies. With this view Sulpicius proposed two measures, first, to recall those who had been exiled on account of the support they had given to the allies; and, secondly, to distribute those Italians who had obtained the franchise, but had been formed into new tribes, among the thirty-five old tribes, the object of which was to increase the weight of their suffrage. (Liv., *Epit.*, 77; Appian, *De Bell. Civ.*, i. 55.) These proposals met with the most determinate opposition from the old citizens, and the Forum became the scene of terrible violence. The popular party, by far the most numerous, would have carried the day, but Sulla, who was with his army in the neighbourhood of Nola, returned to Rome, and in order to put an end to the violent proceedings in the Forum, he and his colleague proclaimed a justitium for several days. But Sulpicius and his party, armed with daggers, appeared in the Forum, declared the proclamation of the consuls to be unlawful, and endeavoured to compel them to repeal the justitium. This again increased the tumult, and Pompeius was obliged to take to flight, and his son, who had married a daughter of Sulla, was murdered. Sulla himself, who had escaped into the house of Marius, was dragged forth and compelled to repeal the justitium, after which he returned to his army at Nola. In the meantime the rogations of Sulpicius were carried, and the command in the war against Mithridates was given to Marius. When the messengers from Rome came to the camp of Sulla with orders for him to surrender the command, the soldiers, who loved Sulla, and who were of opinion that Marius would not lead them to Asia, where they expected a rich harvest of booty, called on Sulla to lead them to Rome. Several officers in the camp, who were opposed to civil war, retired to the city, while numbers of other persons flocked from the city to the camp of Sulla. All signs and omens, to which Sulla pretended to attribute great importance, were in his favour, and, with the declaration that he was going to deliver Rome from its tyrants, he marched with six legions against the city, which he took by storm. A battle followed within the walls, in which Marius and his party were defeated. Marius escaped to Africa, and Sulpicius, betrayed by one of his slaves, was put to death. Sulla and his colleague on this occasion prevented the soldiers as much as possible from committing any outrage upon the citizens. Besides the two leaders of the popular party, ten others were declared enemies of the republic, their property was confiscated, and agents were sent in all directions to discover them, and either to put them to death or to deliver them up to the consuls. (Appian, *De Bell. Civ.*, i. 60; Plut., *Sull.*, 10.)

After this defeat of the Marian party, Sulla repealed the laws of Sulpicius, but he had no leisure for a thorough reform of the constitution, which he appears to have conceived about this time, as his soldiers were anxious to be led to Asia. Appian indeed ascribes some of the most important regulations of Sulla to this time, and it is not improbable that the law which enacted that no measure should be brought before the people which had not previously obtained the sanction of the senate, and another (lex unciaria; Fest., *s. v.* 'unciaria lex'), by which some disputes between debtors and creditors respecting the rate of interest were settled, belong to this period. The other measures, also mentioned by Appian, may have been discussed at the time, but they were not carried into effect until the dictatorship of Sulla. He remained at Rome until the consuls for the year following were elected. The consuls for the year B.C. 87 were Cn. Octavius and L. Cinna. The latter was a man of the popular party, and Sulla, pretending to be glad to see that the people made use of their freedom in the elections, contented himself with making Cinna promise with an oath that he would not disturb the actual order of things. Sulla in the meanwhile felt that his life was not quite safe at Rome, and was therefore constantly accompanied by a strong body-guard. A short time after, the tribune M. Virginius, instigated by Cinna, prosecuted Sulla, who however, without any concern about it, went to Capua to undertake the command of his army, and to proceed with it to Greece, where he intended to commence operations against Mithridates. He landed at Dyrrachium, collected the Roman troops stationed in Greece, and marched towards Athens, which Archelaus, the general of Mithridates, had made his head-quarters. After a long siege and a desperate defence, Athens was taken by storm (86 B.C.), and the garrison of the Acropolis was soon compelled, by want of water and provisions, to surrender at discretion. Piraeeus also fell into the hands of the victor. (Plut. *Sull.*, 11, &c.; Appian, *Mithrid.*, 28-45.) Sulla, who received no supplies from Italy, did not scruple to make use of the rich treasures of the Greek temples, and treated with scorn those who exhorted him not to provoke the anger of the gods. Athens suffered severely, and many of its most magnificent buildings and works of art perished on this occasion, for Sulla's anger had been provoked during the siege by the insulting conduct of Aristion, then tyrant of Athens. Archelaus collected all his forces in Greece, and

after having received great reinforcements from Asia, he was determined to dispute with Sulla the possession of Greece. Though the Roman army was far inferior to that of Archelaus, Sulla gained two victories, one at Chaeronea (B.C. 86), and the other at Orchomenos in Bœotia (85 B.C.), after which he destroyed the towns of Anthedon, Larymna, and Halaeae. (Plut. *Sull.*, 26.)

Although Sulla might now consider himself master of Greece, and might have carried on the war against Mithridates with the best hopes of success, he thought it advisable not to drive Mithridates to extremities, and therefore consented, soon after his landing in Asia, to conclude a peace with him (84 B.C.). [MITHRIDATES.] There were however other reasons for wishing to put an end to the war. During his absence from Italy the popular party had recovered its ascendency, and his own party was almost annihilated: his institutions were abolished, his house was destroyed, and his property confiscated, and he himself was declared an enemy of the republic. The most distinguished senators had been obliged to take refuge in his camp in Greece, and they, together with his wife Cæcilia Metella, who had likewise fled from Rome, urged and entreated him not to forsake them. Two years before the peace with Mithridates, the consul L. Valerius Flaccus, who was of the popular party, had appeared with a fleet and an army in the Ionian Sea, under the pretext of carrying on the war against Mithridates, but perhaps with the secret intention of attacking Sulla. This plan however had not been realised, for Valerius Flaccus was murdered (B.C. 85) by his own legate C. Fimbria, who placed himself at the head of the troops, and was successful in several engagements with the army of Mithridates. After Sulla had concluded a peace with the king in the plains of Troas, he set out against Fimbria, who was stationed with his army in the neighbourhood of Thyatira in Lydia. Fimbria, being betrayed by his own soldiers, put an end to his life. (Plut., *Sull.*, 25.)

Sulla was now at liberty to return with his army from Asia to Italy, but he had still to satisfy the demands of his soldiers, who had expected to enrich themselves in the war against Mithridates. To raise the necessary money, Sulla resorted to the most oppressive measures. Every provincial was obliged to give to every soldier quartered in his house every day a fixed sum of money, and to provide him and as many as he might choose to invite with a daily meal. Besides this, a very heavy contribution of 20,000 talents was raised; in short, Sulla treated the country, which he pretended to have delivered, like that of an enemy. (Plut., *Sull.*, 25.) After he had thus secured the attachment of his soldiers, he left the province of Asia, intrusted the two legions of Fimbria to his legate L. Licinius Murena (Appian, *Mithrid.*, 64), and sailed with his fleet and the remainder of his army, about 30,000 men, from Ephesus to Piræeus. After a voyage of three days, he reached Athens. He took the library of Apellicon, the father of Aristion, which, according to Athenæus (v., p. 211, &c.), belonged to Athenion, and which contained most of the works of Theophrastus and Aristotle. Sulla, who was well able to appreciate such a treasure, carried it with him to Rome. [ARISTOTLE.] While in Greece, Sulla had an attack of the gout, of which he was cured by the use of the warm baths of Ædepsus in Eubœa. During his short stay there he indulged in his usual diversions, and spent the greater part of his time in the company of actors and dancers. He then marched with his army towards the north, through Thessaly and Macedonia to Dyrrachium, and carried his army over to Brundusium in 1200, or, according to Appian (*De Bell. Civ.*, i. 79), in 1600 ships. This passage probably took place in the spring of the year B.C. 83.

The forces of the hostile party in Italy amounted to 200,000 men. (Vell. Pat., ii. 24.) Cinna had increased his preparations as soon as he heard that Sulla was on his way to Italy. In consequence of a letter which Sulla while yet in Asia had addressed to the senate, it had been decreed that negotiations should be entered into in order to effect a reconciliation between Sulla and his enemies, and that Cinna and Carbo, then consuls, should make no further preparations for war. But the consuls paid no attention to this decree, and made preparations for carrying an army into Dalmatia, in order to bring the war to a close in Greece. But when a part of the army was already transported to Dalmatia, a mutiny broke out among the soldiers, and Cinna was murdered, 84 B.C. (Appian, *De Bell. Civ.*, i. 78; Liv., *Epit.*, 83.) The popular party, deprived of their leader, had no alternative but to continue their resistance or to fall victims to the vengeance of Sulla, who had declared that he would pardon none of his enemies. The Italians had made common cause with the democratic party, for they had reason to think that Sulla would be the last man to leave them in the enjoyment of the rights which they had lately acquired. But Sulla endeavoured to deprive his enemies of this support, and while he led his army from Brundusium through Calabria and Apulia into Campania, he carefully prevented his soldiers from doing any injury either to the fields or the towns of the Italians; and he even entered into negotiations with some of them, and assured them that he would not attempt to deprive them of their newly-acquired rights. (Liv., *Epit.*, 86.) Many Romans of distinction also, who had formerly shown themselves rather neutral, such as Pompey, joined his army, and increased his forces considerably. In the first battle which Sulla fought with the consul Narbanus in the neighbourhood of Capua, he was successful; and while a truce was concluded with this conquered enemy the army of the other consul, L. Scipio, was persuaded to abandon their general. In the year following (B.C. 82), when young Marius and Cn. Papirius Carbo were consuls, the war assumed a more serious aspect. Marius undertook the protection of Rome and Latium, and Carbo that of Etruria and Umbria. Marius however was defeated by Sulla in the battle of Sacriportus, upon which he fled to Praeneste, and Rome was taken by the conqueror, after the praetor L. Damasippus, at the request of Marius, had put to death a great number of nobles, and among them even a pontifex maximus, who were suspected of secretly supporting the cause of Sulla. Carbo, who was successively attacked by Metellus Pius, Pompey, and Sulla himself, was compelled to seek refuge in Africa, after he had made a useless attempt to rescue Marius, who was besieged in Praeneste by Q. Lucretius Ofella. The Samnites and Lucanians, who, under the command of Pontius Telesinus and M. Lamponius, likewise made a fruitless attempt to relieve Praeneste, and then marched against Rome, were defeated in a great battle at the Colline gate, in which both armies fought desperately (B.C. 82). The number of the slain on that day is stated to have been 50,000. Sulla, in his inveterate hatred of the Samnites, on the third day after this victory, ordered several thousands of them, who had been made prisoners, to be cut down in the Campus Martius. During the time that this slaughter was going on, Sulla held a meeting of the senate near the scene of horror, and when the senators became uneasy at the groans of the dying prisoners, he told them to listen to what he was proposing, and not to mind what was doing outside. (Appian, *De Bell. Civ.*, i. 84-94; Liv., *Epit.*, 88; Plut., *Sull.*, 30.) This victory was soon followed by the taking of Praeneste. The Romans who were found there among his enemies were pardoned, but the Samnites and Praenestines, amounting, according to Plutarch, to 12,000, were put to the sword. Marius persuaded a slave to put an end to his life.

Sulla's victory was now complete, although some towns of Italy still continued to offer resistance, and although the war was continued in Africa by Carbo and in Spain by Sertorius. Sulla gratified his vengeance by proscriptions, an invention of his own, by which he was enabled to get rid of those whom he had to fear, and to reward his friends and his soldiers. Many thousands were proscribed, that is, were declared out of the protection of the law, and any one was authorised to kill them; and those who killed a proscribed person, or gave notice of his place of concealment, received two talents as a reward, and those who gave shelter to one forfeited their own lives. Lists containing the names of the proscribed were put up in public, and new names were constantly added. The property of the proscribed was seized, and publicly sold or given away. The consequences were, according to the will of the tyrant, to extend to the descendants of the proscribed, inasmuch as they were to be excluded from all honours and public offices. Rome was in a state of utter consternation. But the vengeance of Sulla was not confined to the city. All the Italians who had in any way opposed the party of Sulla were punished in the same manner, and numbers of them were murdered and their property confiscated. Whole cities were punished by the imposition of heavy fines, or by the demolition of their fortifications. Sulla moreover, according to Appian, sent twenty-three, or, according to Livy, forty-seven legions to be distributed as garrisons among the towns of Italy, and granted to them the Roman franchise, together with the lands and

houses which he had taken from their former owners. In the same manner as he thus secured for himself a strong party in the towns of Italy, he formed at Rome for the security of his own person a body-guard consisting of ten thousand slaves, to whom he gave their freedom and the franchise, and who were called, after their patron, Cornelii. The people were thus silenced by fear, and all the acts committed by the tyrant were ratified by a decree of the people (Appian, *De Bell. Civ.*, 97), and a gilt equestrian statue was erected to him in front of the rostra, with the inscription 'Cornelius Sulla, Imperator Felix.'

Sulla now caused the senate to name an interrex, and Valerius Flaccus being appointed, Sulla made him propose to the senate to appoint a dictator to regulate the affairs of Rome and Italy. In accordance with his own expressed wish, Sulla was made dictator (B.C. 82), an office which had not existed for the last 120 years, and which he was permitted to hold as long as he pleased. In order however to leave to the people some appearance of liberty, he permitted them to elect consuls as usual, and he himself, in B.C. 80, held the office of consul in addition to that of dictator. In the year B.C. 81, he enjoyed a triumph for his victories in the war against Mithridates, and his splendid games and feastings, which lasted for several days, made the people forget for a time their wretched condition. (Appian, *De Bell. Civ.*, 101.) After his triumph he claimed the surname of Felix, and pretended that all his success against his enemies was owing to the favour of the gods, especially of Venus, which he had enjoyed from his early youth. Hence he also called himself Epaphroditus. But although he sometimes affected gratitude towards the gods, in reality he cared little about them, and he did not scruple to plunder their temples and to treat with scorn and contempt the signs which appeared to deter him from his sacrilegious actions. (Plut., *Sull.*, 12.)

After Sulla had completely annihilated the popular party, he began to direct his attention to a reform in the constitution and in the administration of justice. Zachariae, a great admirer of the political wisdom of Sulla, divides all his laws which are known under the name of 'Leges Corneliae,' into three great classes:—1. constitutional regulations; 2. criminal laws; and 3. those which were intended to improve public morals.

The constitutional laws of Sulla were intended to restore the old aristocratic form of the republic, but such a restoration could only be a matter of form, as it had no longer its hold in the hearts and minds of the Romans. As a politician Sulla was one of those short-sighted men who believe that old institutions can be revived or preserved by the mere letter of the law, though that which formerly alone gave stability to them, the spirit of the nation, has become entirely altered. The consequence was that the constitution of Sulla did not survive him many years. The principal part of his reform consisted in depriving the comitia tributa of all their legislative and judicial powers, and of the right to elect the members of the great colleges of priests, which the people had exercised for some time. He left to the comitia of the tribes only the power to elect the inferior magistrates, as tribunes, aediles, and quaestors. The power of the tribunes of the people thus received a fatal blow. Some writers are of opinion that Sulla abolished the assemblies of the tribes altogether. The whole of the legislative power was given to the Comitia Centuriata, but in such a manner that no legislative measure could be brought before them, without having previously received the sanction of the senate. He also allowed no appeal to the people from the sentence of a magistrate The vacancies which had occurred in the senate through the late calamities were filled up by the admission of 300 of the most distinguished equites (Appian, *De Bell. Civ.*, i. 100). [SENATUS.] He increased the number of pontiffs and augurs to fifteen. [AUGUR; PONTIFEX.]

Sulla appears greatest in his laws relating to the administration of justice. All the Roman writers agree that Sulla gave the judicia (either the publica and privata, or the former alone) to the senate. We cannot enter here into an account of the various laws relating to criminal and civil jurisdiction; but, before the time of Sulla, the criminal legislation of Rome was extremely imperfect, and he was the first who brought order and system into this important branch of administration; and this part of his reform was not abolished after his death, but most of his laws continued in force down to the latest times of the empire. His legislation embraced a great variety of subjects. A list of his laws, together with a critical examination of their nature and tendency, may be found in the works mentioned at the end of this article.

The laws which Sulla enacted, with a view to improve the state of public morals, related chiefly to marriage and luxury (leges sumtuariae). But Sulla, though anxious to improve the moral condition of the people, was the last man to observe any laws of the kind. (Plut., *Sull.*, 35; *Comparat Lysand. c. Sulla.*)

After the annihilation of all his enemies, and the establishment of a new order of things, Sulla once more felt a desire to enjoy those pleasures to which he had been addicted from his early youth, and without the interruption necessarily arising from being at the head of the republic. Accordingly he did not accept the consulship for the year B.C. 79, and soon after declared to the assembled people that he resigned his power and dignity of dictator, and that he was ready to render an account to them of the manner in which he had exercised his power. As might have been expected, no one ventured to take him at his word; only one young man is said to have dared to accuse him, and to have followed the ex-dictator on his way home with bitter invectives, to which Sulla only made this calm remark: 'This youth will prevent any one in future, after having once acquired great power, from being inclined to lay it down.' The abdication of Sulla in the height of his power has called forth the admiration of both antient and modern writers; but an accurate examination of the state of affairs in Rome and Italy, and a consideration of the sensual disposition of Sulla, deprive this act of much of its apparent magnanimity. As regards his own inclination, it can only be said that his love of pleasure unincumbered by public affairs was greater than his love of power. The 10,000 Cornelii remained after his abdication as attached to him as they had been before, and they were ready to take up arms for their patron at any moment, as their own safety depended upon his. The party of Sulla was in possession of all the power at Rome, and in Italy his numerous legions were as ready to take up arms in his defence as the Cornelii. He could therefore withdraw without any danger or fear, and how well he had calculated is clear from Plutarch (*Sull.*, 37), for even during his retirement to private life his will was regarded as law. Soon after his abdication he retired to his villa near Puteoli, where he spent his time partly in literary occupations, partly in hunting and fishing, and partly in giving himself up to the pleasures of the table, and of women, actors, and dancers. (Plut., *Sull.*, 36.) He died in the year B.C. 78, at the age of sixty. The cause of his death is not quite certain. Appian (*De Bell Civ.*, i. 105) says he died of an attack of fever, while others inform us that the loathsome disease called phthiriasis was the cause of his death. (Plut., *Sull*, 36; Plin., *Hist. Nat.*, xxvi. 86; xi. 39; vii. 44; Aurel. Vict., *De Vir. Illustr.*, 75; Paus., i. 20, 4.) Two days before his death Sulla had finished the twenty-second book of his 'Memoirs,' of which we probably possess a considerable part in his Life by Plutarch. His body was carried to Rome with great pomp, and burnt in the Campus Martius according to his own request. A monument also was erected to his memory in the Campus Martius, with an inscription said to have been written by Sulla himself. (Plut., *Sull*, 38.)

Sulla was married five times, and left two children, Faustus Cornelius Sulla and Fausta, who were twins by his fourth wife Caecilia Metella. One daughter was borne, after his death, by his fifth wife Valeria.

6. FAUSTUS CORNELIUS SULLA, son of the dictator Sulla (5) and of Caecilia Metella (Plut., *Sull.*, 34), was born in 89 B.C. After the death of his father he was under the guardianship of L. Lucullus. He was several times in danger of being compelled to restore the money which his father had unlawfully appropriated to himself. The senate however always prevented an inquiry being instituted, as some of the body would have been compromised by it. In 66 B.C. a tribune of the people renewed the attempt, but Sulla again escaped, chiefly through the influence of Cicero, who spoke for him. (Ascon., in *Cic. Cornel.*, p. 72, Orelli: Cic., *Pro Cluent.*, 34; *De Leg. Agr.*, i. 4.) He served under Pompey in Asia, and in 63 B.C. he was the first who scaled the walls of the temple of Jerusalem, for which act of bra-

very he was richly rewarded. (Joseph., *Ant. Jud.*, xiv. 4; *Bell. Jud.*, i. 7, 4.) In B.C. 60 he gave to the people the gladiatorial games which he had been requested to give by his father in his last will, and on this occasion he treated the people most munificently; he made them donations of money, and allowed them the use of the baths without any payment. (Dion Cass., xxxvii. 51; Cic., *Pro Sulla*, 19.) In the year B.C. 54 he obtained the quaestorship, after he had some years before been made a member of the college of augurs. (Dion Cass., xxxix. 17.) After the murder of Clodius, Faustus was requested by the senate to restore the Curia Hostilia, and it was decreed that after its restoration it should be called Curia Cornelia. (Dion Cass., xl. 50.) Faustus Sulla did not obtain any higher office than the quaestorship; his dissolute mode of life had ruined his fortune. As regards his political views, he had joined the party of Pompey, whose daughter he married. In B.C. 49 Pompey wished him to be sent as propraetor to Mauritania, but it was prevented by the tribune Philippus. (Cæs., *De Bell. Civ.*, i. 6.) During the troubles of the civil war between Pompey and Cæsar, Sulla's only object appears to have been to enrich himself. He was present in the battle of Pharsalus, and thence fled to Africa, where his fate was decided in the battle of Thapsus (46 B.C.). He attempted to escape to Spain, but was taken prisoner and delivered to Cæsar, in whose camp he was murdered during a mutiny of the soldiers. His wife and children however were set at liberty. (Cæs., *De Bell. Afr.*, 95; Appian, *De Bell. Civ.*, ii. 100.) Of his twin-sister Fausta nothing is known, except that she married twice, and each time was guilty of adultery. (Ascon., in *Cic. pro Scaur.*, p. 29.)

7. P. Cornelius Sulla, a son of Servius Cornelius Sulla, was a brother of the dictator, and enriched himself considerably during the proscriptions. (Dion Cass., xxxvi. 27; Cic., *De Off.*, ii. 8.) In 66 B.C., P. Cornelius Sulla and P. Autronius Paetus were elected consuls; but both were found guilty of ambitus (bribery), and deprived of their dignity. (Cic., *Pro Sulla.*) He is also believed to have been an accomplice of Catiline in his first conspiracy, and in B.C. 62 he was accused by L. Torquatus of having taken part in both the conspiracies of Catiline. Several men of distinction lent him their protection, and Hortensius and Cicero spoke for him. The speech of the latter is still extant. Sulla was acquitted, but there is every reason for believing that he was guilty of the crime with which he was charged. Cicero's defense was evidently not made without some apprehension and embarrassment. (See also Sallust, *Cat.*, 17.) Cicero subsequently fell out with Sulla, as the latter was to some extent involved in the crimes of Clodius. (Cic., *Ad Att.*, iv. 3.) In the civil war between Pompey and Cæsar, Sulla served as legate in the army of Cæsar during the battle of Pharsalus. (Appian, *De Bell. Civ.*, ii. 76; Cæs., *De Bell. Civ.*, iii. 51, 89.) In 47 B.C., when he was commanded to transport the legions destined for Africa from Italy to Sicily, he was pelted with stones by the soldiers of the twelfth legion, and driven away, for before embarking for Sicily they claimed the money and lands which they had been promised during the campaign in Thessaly. (Cic., *Ad Att.*, xi. 21, &c.) During the confiscations and sales of property in the dictatorship of Cæsar, Sulla acquired considerable wealth by the purchase of such property. (Cic., *De Off.*, ii. 8; *Ad Fam.*, xv. 19) In the year B.C. 45 he died on a journey: some said that he had been murdered by robbers, others that he died of overeating himself; but the people appear to have rejoiced at having got rid of such a worthless person. (Cic., *Ad Att.*, ix. 10; xv. 17.) He left behind him a son, P. Sulla, and a son-in-law of the name of Memmius, of whom nothing worth mentioning is known. (Cic., *Ad Fam.*, xv. 17; *Ad Q. Frat.*, iii. 3; *Pro Sulla*, 31.)

8. Servius Cornelius Sulla, a brother of P. Cornelius Sulla (7). He took part in the conspiracy of Catiline (Sallust, *Cat.*, 17, 47); but he was not condemned to death, although his guilt was so manifest, that no one would undertake his defence. (Cic., *Pro Sull.*, 2.)

The last person of any note bearing the name of Sulla in the history of Rome occurs in the reigns of Claudius and Nero. He was a son-in-law of the emperor Claudius (Suetonius, *Claud.*, 27; Tacitus, *Annal.*, xiii. 23), and was consul in A.D. 52. According to the information of one Paetus, Pallas and Burrhus intended to raise him to the imperial power. This charge was found to be false: but Nero nevertheless dreaded Sulla, believing him to be a cunning and crafty person. Some false report subsequently increased this fear of Nero, who, in A.D. 59, sent him into exile to Massilia. (Tacit., *Annal.*, xiii. 47.) But as the emperor apprehended that Sulla might here induce the German legions to revolt, he ordered him to be put to death, which took place in A.D. 63. (Tacit., *Annal.*, xiv. 57.)

(Respecting the history of the family of the Sullas, see Orelli, *Onomasticon Tullianum*, ii., p. 192, &c.; Drumann, *Geschichte Roms in seinem Uebergange*, &c., ii., p. 426, &c.; Pauly's *Real-Encyclopaed. der Alterthumswissenschaft*, ii., p. 668, &c. For the history of the dictator Sulla, and his legislation in particular, see Zachariae, *L. Cornelius Sulla, genannt der Glückliche, als Ordner des Römischen Freystaates*, Heidelberg, 1834, 2 vols. 8vo.; Vockestaert, *Dissertatio Historico-Juridica de L. Cornelio Sulla legislatore*, Ludg. Batav., 1816, 8vo.; A. Wittich, *De Rei Publicae Romanae ea forma, qua L. Cornelius Sulla dictator totam rem Romanam ordinibus, magistratibus, comitiis commutavit*, Lipsiae, 1834, 8vo.; and a Latin dissertation by C. Ramshorn, which bears the same title as that by Wittich, and was published at Leipzig, in 1835, 8vo.)

SULLY, MAXIMILIEN DE BETHUNE, DUC DE, born at Rosny, on the 13th of December, 1560, was descended from a younger branch of the family of Bethune, in the Netherlands. His ancestors had by their own exertions and wealthy marriages raised themselves to importance in their adopted country of France; but the grandfather of Maximilien had squandered away his inheritance, and left to his son nothing but a proud name and his mother's dowry. François de Bethune, baron of Rosny, was a sagacious man, but not possessed of sufficient talent to re-establish the family fortune, and his adoption of the Protestant religion, by alienating him from his relations, forbade all hopes of improving his inheritance. His eldest son was feeble in mind and body, and the cherished wish to see prosperity return to his house rested upon the second, the more energetic Maximilien. His expectations from this quarter were strengthened by the predictions of astrologers. The first lesson impressed upon the boy's mind was the duty of devoting himself to the aggrandizement of the family. The moral and religious tenets of the Huguenots were at the same time sedulously instilled into him. These early impressions moulded a strong, fearless, and enterprising character, and decided his career in life.

In 1572 François de Bethune carried his son to the court of Henri, the young king of Navarre, then in his twentieth year, having previously commanded the boy in a solemn and impressive manner to live and die with the master he gave him. Young Rosny accompanied the king of Navarre, who was at that time on his way to Paris, to conclude his matrimonial engagement with the king's sister. In Paris he paid his court daily to Henri, but resided at some distance, in the quarter where most of the colleges were situated, with a governor, and attended the classes of the College of Burgundy. By the assistance of the principal of that institution he escaped the massacre of St. Bartholomew, though the horrors of that night left a lasting impression on his mind. At the command of his father he continued to reside in Paris, but his literary studies were abruptly closed. His governor perished in the massacre; and his preceptor was too terrified to remain in Paris. The king of Navarre however supplied the place of the tutor with one who gave Rosny instructions in history and mathematics, and the rest of the boy's time was spent, according to his own account, in learning to read and write well. He continued occupied with these pursuits till the beginning of 1575, when he accompanied Henri in his escape from the state of confinement in which he was kept by the French court.

The Protestants had by this time recovered from the dismay into which the massacre of St. Bartholomew had thrown them; had made common cause with their Roman Catholic fellow-subjects in remonstrating against fiscal grievances; and had at last ventured to take up arms again. The king of Navarre and the prince of Condé were in a great measure identified with the Protestant cause; and the duke of Anjou, who had at this time some cause of quarrel with the court, formed an alliance with them. Immediately after the escape of Henri these three princes found themselves at the head of a mixed army of Roman Catholics and Protestants, amounting to 35,000 men. The civil war, which imme-

diately broke out, was continued with a few brief intervals of hollow truce till 1594. The studies of Rosny, who accompanied Henri in his flight from Paris, were finally broken off by that event. In his fifteenth year he was immersed in the toils and cares of active life: the death of his father about the same time left him entirely his own master. It was in nineteen years of civil war that he developed and cultivated without guide or master the character and talents which he displayed as minister of France.

At first Rosny accepted an ensigncy in the regiment of foot of which his relation Lavardin was colonel. In the first skirmishes in which he was engaged he evinced so much temerity, that Henri was more than once obliged to rebuke him. It was only in battle however that he showed any degree of boyish thoughtlessness; in the management of his pecuniary affairs he displayed a prudence beyond his years. The rents of his property and the booty he obtained in the storming of several towns, enabled him to maintain a small company of men-at-arms; and with these, resigning his ensigncy, he attached himself exclusively to the person of the king of Navarre. The courage and enterprise of so young a lad, the enthusiasm with which he sought to make himself master of the art of gunnery, and above all the prudence which he manifested in his domestic arrangements, led Henri to cherish so promising a servant. Rosny was made a councillor of Navarre in his twentieth year, with a salary of 2000 livres.

It was soon after this promotion that he was induced to make one in the retinue of the duke of Anjou, who had been invited to assume the sovereignty of the Low Countries. The bait which attracted Rosny was the promise of having his claims to the inheritance of the viscount of Ghent supported by the new king, and the opportunity of reconciling himself to his Flemish relations. He found himself disappointed in both, and returned in 1583 to the king of Navarre, no otherwise benefited by his excursion to the Netherlands than by the acquisition of more knowledge of the world and greater experience in war. He was almost immediately dispatched to Paris to keep an eye upon the intrigues there going forward.

In December, 1583, he married Anne de Courtney, and spent the whole of 1584 with his young wife upon his estate of Rosny. Though retired from public life, he was not idle: he had been obliged on several occasions to deal extensively in horses for the purpose of mounting his troop; and during the year he resided in the country he extended his dealings, sending out agents, who purchased horses in Spain and other countries at mere nominal prices, and sold them at a high rate in the provinces which were the seat of hostilities. His husbandry was so good, that when he rejoined Henri in 1585, he carried not only himself and his troop, but a good round sum of money to assist his master in prosecuting the war. Rosny's devotion to the cause of Henri was deep and unalterable. It was a mixture of personal attachment, of a sense of duty, on account of the solemn injunction of his father, and of a steady belief, resting partly upon the conclusions of his own shrewd judgment and partly upon belief in the predictions of astrologers, that his master was destined to be one day king of France, and himself to rise to eminence in his service. Henri was at the moment in need of such an able and devoted servant. As presumptive heir to the crown of France, he had an interest apart from that of the Protestants; and at the same time the leaders of the Protestant party were anxious to make of France a federation of independent principalities, while his policy was to consolidate the power of the crown. His Roman Catholic retainers were even less to be depended upon than the Protestants, for their aversion to his heresy naturally rendered them lukewarm in his service. In the course of some conferences of the Protestant leaders, Rosny zealously opposed the specious pretexts by which they sought to cloak their efforts for personal aggrandizement, and maintained the necessity of concentrating their forces under one leader. At the close of one of these discussions the king of Navarre told him that now was the time for acting as well as arguing boldly: asked whether he was willing to put all to the hazard in his service, and pledged his honour that, should he succeed, Rosny should share in his prosperity. Rosny promised that all his means should be at Henri's disposal; and was from that moment one of his master's most valued counsellors, as he was one of his bravest soldiers. He was employed in many delicate and difficult negotiations; and at the battle of Coutras (20th October, 1587), where he commanded the small park of artillery, he contributed mainly, by his skilful employment of it, to the gaining the victory.

That victory was thrown away in consequence of the disunion of the Protestant leaders; and the ensuing year was wasted in skirmishes which led to nothing. The death of the queen-mother, in January, 1589, followed in rapid succession by the assassination of the duke of Guise and the insurrection of the Parisians, forced on an alliance between Henri III. and his heir presumptive. Rosny was not in a condition to take an active part in the operations which ensued. The death of his wife kept him fettered for some time in hopeless gloom, and when he rejoined the army before Paris, it was in the mood of a man who braved death as a relief from painful thoughts. He was startled out of his despondency by the assassination of the king of France (2nd August, 1589), and the succession of the king of Navarre as Henri IV.

The services of Rosny from this time till the entry of Henri into Paris (21st March, 1594) were many and weighty. He fought at the battle of Arque; he was dangerously wounded at the battle of Ivry; he detected the intrigues on foot among the Roman Catholics with a view of forming a 'tiers parti,' which those who distrusted the League might be induced to join, and which should be equally hostile to Henri. This last discovery opened the eyes of Sully to the impossibility of a Protestant obtaining secure possession of the crown of France; and from that moment his part was taken. He urged upon Henri the necessity of re-entering the Roman Catholic church, and ultimately succeeded in overcoming his not very strong reluctance to the step. Rosny was thus the main instrument in opening the gates of Paris to his master; and to this obligation he added, about the same time, that of gaining for him the services of the grand-admiral Villars and the possession of Rouen. Amid all these occupations he found time to marry again, in May, 1594: his second wife was Rachel Cochefilet, widow of the Sieur de Châteaupers.

Long before Henri, by changing his religion and obtaining possession of Paris, had established himself securely on the throne of France, he had felt severely the dilapidated state of the national finances. One of his first wishes, on finding himself in a state of comparative tranquillity, was to secure the services of Rosny, in whose fidelity and talents he had the greatest confidence, in this important department of the state. Two difficulties prevented the immediate gratification of this wish; the danger of exciting jealousy by advancing a Protestant, and the reluctance of the professional financiers to admit one not of their class into a knowledge of its secrets. The king hesitated for two years before he could gather courage to beat down these obstacles; but the malversations continued to increase so shamelessly, that in 1596 Rosny was formally installed a member of the great council of finance.

His first step was to obtain from the king the appointment of a commission of inquiry into the state of the revenue and its collection in all the districts into which the kingdom was divided for financial purposes. Four of the principal districts were reserved for his own inspection. In the course of a tour he made through them he detected the various means by which money was diverted from the treasury, and the king kept poor at the same time that over-exactions were levied upon the people. He collected arrears of taxes which had been allowed to lie over, and returned to Paris not only with evidence of abuses in the management of the finances, but with a considerable sum of money in hand. An assembly of notables was held at Rouen soon after his return. The king left Rosny to deal with the representatives of the states, and succeeded in obtaining a grant of some new imposts for the king, and frustrating in a manner that gave no umbrage an attempt made by the assembly to establish a board of control over the royal treasury. He was now promoted to be superintendent of finance, and entered upon the discharge of his duties with a zeal that amounted almost to a passion. He was indefatigable in his examination of the state records, with a view to make himself familiar with the origin and actual character of the different branches of revenue, and the methods of levying them and securing the money they yielded. Having mastered this knowledge, he availed himself of it to organise thoroughly the financial establishment; and he superintended with unremitting vigilance the working of the machine which he constructed. Soon after he commenced operations, he induced the king to order that the surplus receipts of each year should at its

close be deposited, in money, in the Bastile. When he undertook the management of the finances, in 1597, the treasury was empty and in debt; after the death of Henri IV., in 1610, forty-two millions of livres were found in it.

The method and regularity which Rosny had introduced into the finances, suggested a wish that he should lend his assistance towards bringing the other departments of government into similar order. He was appointed in succession to be grand-master of the artillery, director of the marine, master of works, and director of bridges and highways. He became in fact sole minister of France. Six days of the week councils were held every morning and evening. On Mondays, Thursdays, and Saturdays, the council of state and finances sat both in the forenoon and the evening: on the other three days special councils were held—of war, commerce, &c. Rosny attended all, and presided in all whenever the king was absent, which was frequently the case.

In addition to these duties of routine, he was frequently engaged in important negotiations. In 1601 he was delegated to meet Queen Elizabeth at Dover, where arrangements were made for an alliance against the house of Austria. In 1603 he was sent as ambassador to James VI. on his succession. Honours and emoluments flowed in upon him. The grand-mastership of the artillery produced him an annual income of 24,000 livres; his office of counsellor of state as much; he held several governments, the appointment of a counsellor of Navarre, the command of a troop, to all of which considerable pensions were attached, and he received from time to time considerable presents from Henri. In 1606 he was created Duc de Sully and a peer of France. And his advice was taken and his services employed by the king in his most delicate family arrangements, as well as in the affairs of the state.

The murder of Henri IV. in 1610 terminated the career f Sully as minister. He stood alone after the death of him to whom alone he had devoted himself; obnoxious to envy and intrigue on account of his power and wealth, doubly obnoxious as a Protestant. He continued for some time to attend the council as usual, but finding himself systematically thwarted by the favourites of the new court, he made preparations for resigning in the commencement of 1611, and early in that year formally gave up the offices of superintendent of finance and governor of the Bastile.

From that time the château of Villebon became his principal residence. In the spring and autumn of every year he visited Sully and Rosny. He had retained his government of Poitou, and the direction of the artillery, the fortifications, and the roads and bridges; so, though retired from court, his life was neither private nor inactive. He attended at least one conference of the Protestants; but refused to take part in any of their armaments. He retained the respect of the court, and was appointed a marshal of France by Louis XIII., in 1634. The favourite amusement of his declining years consisted in preparing his Memoirs ' of the great and royal economies of Henri IV.' for publication. He took a keen interest in the management of his estates. The prodigality of his son (who died before him) involved him in some disagreeable embarrassments; and the decision against him of a suit which his grandson had been instigated to commence is supposed to have hastened his death. He died at Villebon, December 22, 1641.

Sully was essentially a man of action: except for history, and those branches of knowledge which are useful to the soldier and practical statesman, he seems to have had little literary taste. He was fearless, enterprising, and persevering. His appetites were not inordinate, and were held in constant control by his powerful will. He had a clear and just perception of character. He had naturally a love of order and dispatch, which were strengthened by habit. His theoretical views of society and political economy do not evince much profundity; and the strange and cumbrous arrangement of his Memoirs would seem to indicate that he laboured under the same inability to tell a plain story briefly and intelligibly, which has been observed in others eminent for the clearness of apprehension displayed in their actions. His moral creed seems to have closely resembled that of the contemporary Puritans of England. It is more difficult to conjecture what were his religious opinions. With great temptations to abjure the Protestant faith, he continued to profess it to the last. Yet he advised Henri IV. to reconcile himself to the Roman Catholic church, and his affection for that king is beyond a doubt. Nor can his adherence to Protestantism be explained upon the assumption that he was influenced by a partisan point of honour; for he was more a Frenchman than a Protestant, and invariably sacrificed the party interests of the Huguenots to the broad interests of the nation. His devotion to Henri was not without a tinge of superstition; it was long affected by the predictions of astrologers, if it was ever entirely cleared of them. His love of state, and display in his apparel, household, and attendants, is another indication of something imaginative peeping out from under his stern practical character; as is also the fragment of a romance of the Scudery school found among his papers after his death. Yet he had no tolerance for what weaklings call sentiment, as may be gathered from his own account of his first marriage; and from his sturdy and fearless opposition to the follies into which that weakness frequently led his master. Sully was not exactly a person to be loved, but he was one to be reverenced and implicitly trusted. He was perhaps a servant such as no king but Henri IV. ever had; as Henri on his part was qualified to win the affectionate devotion of such a servant beyond any king who ever existed. The administration of Sully is an important chapter in the history of France: the subsequent fortunes of that nation cannot be thoroughly understood unless by one who has studied attentively his operations.

(The principal authority for the facts stated in this sketch is Sully's own work; but some assistance has been derived from De Thou and other contemporary writers.)

SULLY, HENRY. [HOROLOGY.]

SULMO'NA, a town of the kingdom of Naples, in the province of Abruzzo Ultra II., is the chief town of one of the four districts into which that province is divided. It lies in a deep valley drained by the Sagittario, an affluent of the Pescara, surrounded by high and naked mountains, having the central ridge of the Apennines on the west, and the lofty group of Majella, an offset of the Apennines, on the east. This valley forms an important pass between the central and northern provinces of the kingdom, leading from the valley of the Pescara to that of the Sangro, from whence the road is continued to the valley of the Volturno by Isernia. The antient Sulmo, Ovid's birth-place, which was at some distance from the site of the modern Sulmona, has been completely destroyed; a few remains of a temple of Jupiter are visible at S. Quirini, two miles from Sulmona. The modern town, which is walled, looks old and gloomy, like most towns of Abruzzo. It is a bishop's see, has about 8000 inhabitants, a college, a clerical seminary, some paper-mills, and manufactories of catgut, sugar-plums, and sausages. Much wine is made in the neighbourhood, as well as oil, and corn is reaped in considerable quantity. The valley of Sulmona is intersected by several streams, and irrigated by artificial canals. Ovid, in several places of his 'Tristia,' recalls to mind the copious and cool streams of his native country.

Some of the churches of Sulmona are worthy of notice: in that of La Badia is the tomb of Giacomo Caldora, a celebrated condottiere in the fifteenth century, who died suddenly in the Abruzzi at the head of his army, whilst supporting the claims of King René of Anjou against Alfonso of Aragon. The latter, having taken Sulmona, is said to have forgiven the town for the sake of its native poet Ovid. Near Sulmona is the splendid monastery of S Spirito di Morone, belonging formerly to the wealthy order of Celestines, now suppressed. In the town above the barrack gate there is a piece of wretched sculpture, which the inhabitants are pleased to style a statue of their townsman Ovid, of whom they seem very proud.

Sulmo was one of the chief towns of the Peligni, a people of Sabine origin, like their neighbours the Marsi, with whom they were allied. Corfinium, another town of the Peligni, was in the same valley, a few miles north of Sulmo, and the remains of the antient canal cut in the rock are still seen. (Afan di Rivera, *Considerazioni*, &c.) The Peligni, having joined the Marsi and Samnites against Rome, were defeated by the consul M. Fabius, 445 B.C. Four years afterwards, the Peligni, together with the Marsi, Frentani, and Marrucini, sent orators to Rome to sue for peace, which was granted. (Livy, ix., 45, 49.) During the second Punic war we find a body of Peligni, under its præfect Vibius Accuæus, fighting bravely as auxiliaries of the Romans against the Carthaginian commander Hanno, near Beneventum (xxv. 14). The Peligni, were foremost in the confederacy which carried on the Social war against Rome.

and their town Corfinium, under the name of Italica, was made the capital of the league. They were however defeated by the legate Servius Sulpicius (*Epitome*, 73), and they made their submission, together with the Vestini, to the proconsul Cn. Pompeius.

SULO ARCHIPELAGO. [SOOLOO ARCHIPELAGO.]

SULPHATES and SULPHITES. [SULPHUR.]

SULPHOCYANIC ACID and SULPHOCYANOGEN. [SULPHUR.]

SULPHONAPHTHALIC ACID and SULPHONAPHTHALIN. [SULPHUR.]

SULPHOVINIC ACID. [SULPHUR.]

SULPHUR, commonly called *brimstone*, is a solid elementary non-metallic body, which has been known from the remotest antiquity. It is met with pure and in various states of combination: thus it is found combined with numerous metals and in immense quantity, as with iron, forming the sulphuret and bi-sulphuret, with copper, lead, antimony, &c., constituting the principal ores of these metals: it is also found largely combined with oxygen, forming sulphuric acid, which is generally united with an earthy base, as with lime, constituting sulphate of lime, or gypsum, and with barytes, strontia, and magnesia, giving rise to the sulphates of these bases. It occurs also, but in smaller quantity, and principally in mineral waters, such as those of Harrowgate, combined with hydrogen, the resulting compound being sulphuretted hydrogen gas, or hydrosulphuric acid. Sulphur is also a constituent of some animal substances, as eggs, urine, &c.: it is found also in certain plants; in *Liliaceæ*, as in garlic, *Cruciferæ*, as in mustard, and *Umbelliferæ*, as in *Asafætida*.

Native Sulphur.—This occurs massive and crystallized. Primary form of the crystal a right rhombic prism, the usual form being the secondary one of an acute octohedron with a rhombic base. Cleavage parallel to the lateral faces of the primary form. Fracture conchoidal. Hardness sufficient to scratch sulphate of lime, but is scratched by carbonate of lime. It is very brittle. Becomes negatively electrical by friction. Colour various shades of yellow, sometimes greenish, and reddish. Streak paler. Lustre resinous and shining. Odour slight, unless heated or rubbed. Transparent: translucent; opaque. Refraction double. Specific gravity 2·072.

Massive Varieties.—Amorphous, structure crystalline, granular, compact. Stalactitic; structure compact.

Sulphur is found in veins and beds. In Suabia in veins traversing granite; near Schemnitz in Hungary, in mica slate; and at Bex in Switzerland, in limestone and gypsum of the salt deposit; and in this kind of deposit it occurs most abundantly, generally in beds, or disseminated in large masses.

Sulphur is procured sometimes by the decomposition of iron pyrites, or bisulphuret of iron.

Volcanic Sulphur.—The most remarkable deposit is that of Solfatara near Naples, whence an immense quantity is imported into this country. It occurs also in the fissures of lava near the craters of volcanoes, in Italy, Guadaloupe, Nevis, and the volcanoes of the Cordilleras.

Sulphur is purified in this country, and has different forms given to it according to circumstances; what is called *refined sulphur* is purified by distillation in a large cast-iron still, and it is condensed in an iron receiver kept cool by water. When melted and cast into wooden moulds, it is called *roll* or *stick sulphur*; and when the vaporized sulphur is condensed in a large chamber, it has the form of powder, and is called *sublimed sulphur*, or *flowers of sulphur*.

We shall now describe such of the physical and chemical properties of sulphur as have not been mentioned under *Native Sulphur*. Sulphur is insoluble in water, but dissolves in alcohol, if both substances are exposed to each other in the state of vapour: on the addition of water, the sulphur is precipitated. It is dissolved by boiling oil of turpentine: the solution has a reddish-brown colour, and, on cooling, minute crystals of sulphur are deposited.

Sulphur is a bad conductor of heat: it is very volatile, and when it is rubbed in the dark on a brick, on any other substance by which it is heated, though not sufficiently to inflame it, an extremely weak blue flame arises, exhaling a peculiar odour: this flame is not however occasioned by combustion, it merely accompanies the evaporation of the sulphur, for a cold body held over it is covered with flowers of sulphur. When sulphur is heated, it begins to vaporize before it fuses: at 550° to 600° it is rapidly volatilized, and in close vessels is condensed without change. The specific gravity of the vapour of sulphur is about 6·64. Some metals when heated in it burn vividly. The fusing-point of sulphur is 232°, and between this and 280° it possesses the highest degree of fluidity: at 320° it begins to thicken, and at 482° is so tenacious, that it will not flow from an inverted vessel: from this to 600°, which is its boiling-point, it again becomes liquid, but not so perfectly so as at 280°: when boiling in closed vessels, an orange coloured vapour is formed. When poured into water in a fluid state, at about the temperature of 428°, it becomes a brown pasty mass, which readily receives and retains any form given to it, and hence it is employed in taking casts.

Sulphur is what is called a *dimorphous* body; that is to say, it crystallizes in two different and incompatible forms. It has been already stated that the primary form of native sulphur is a right rhombic prism, whilst that of sulphur artificially crystallized by fusion and cooling is an oblique rhombic prism.

Oxygen and Sulphur form several compounds, but there is no mere oxide of sulphur, all the compounds of these elements possessing acid properties: the first compound of them which we shall describe is—

Sulphurous Acid.—It is to be observed that oxygen and sulphur do not combine at the usual temperature of the air; but when sulphur is heated in the air to a little above 300°, it takes fire and burns with a pale blue light: in oxygen gas the combustion is much more vivid, the flame is much larger, and is of a bluish-white colour; the product of this action is sulphurous acid gas. This gas was discovered by Dr. Priestley. It is not perhaps possible to saturate oxygen gas with sulphur by burning the latter in the former; but it may be, when obtained in the mode we shall presently point out.

The properties of sulphurous acid gas are, that it is colourless, permanently elastic, that is, not condensed into a fluid or solid by exposure to common degrees of cold under the ordinary pressure; but at a temperature of 45°, and a pressure equal to two atmospheres, it is rendered fluid. Sulphurous acid gas has a pungent and suffocating odour, being that experienced whenever sulphur is burned: its taste is disagreeable and acid: it extinguishes burning bodies, is not inflammable, and is fatal to animals. Water at 60° dissolves from 33 to 37 times its volume of this gas; and by heating the solution it is evolved unaltered. The solution possesses the smell of the gas itself; and, like it, has the property of bleaching some vegetable and animal substances: hence the employment of the vapour of burning sulphur in whitening hops, silk, and wool.

Sulphurous acid gas is composed of—

Two equivalents of oxygen .	16 or	50
One equivalent of sulphur .	16 ..	50
Equivalent . .	32	100

Or it may be regarded as consisting of 100 cubic inches of oxygen gas, weighing 34·4 grains combined with and holding in solution 34·4 grains of sulphur; and as the oxygen suffers no alteration of volume, the 100 cubic inches of sulphurous acid gas weigh 68·8 grains: its density therefore is to that of atmospheric air as 2·22, very nearly, to 1.

The aqueous solution of sulphurous acid, when exposed to oxygen, slowly combines with it, and the result is sulphuric acid; but unless moisture be present, no combination takes place between these two gases.

Sulphurous acid combines with various bases to form salts, which are called *sulphites*. When, for example, this gas is passed into an aqueous solution of ammonia, they readily combine, and the resulting salt is sulphite of ammonia, which may be obtained in prismatic crystals. It is very soluble in water, and produces much cold during solution; by exposure to the air it attracts oxygen, and becomes sulphate of ammonia. When however dry sulphurous acid gas and dry ammoniacal gas are brought into contact, it appears that deep yellow-coloured crystals are formed, which have been termed *sulfimide*: they contain the elements of sulphurous acid and ammonia combined, but in a different mode, to form that which forms anhydrous sulphite of ammonia. By exposure to the air sulfimide becomes white, deliquesces, and gradually becomes sulphate and hyposulphate of ammonia.

The alkalis potash and soda, the alkaline earths, and several metallic oxides, may be combined with sulphurous acid, and they form *sulphites*; but these compounds are not of

sufficient importance to require description: by exposure to the air they all become *sulphates*.

Sulphuric Acid. This acid has been long known, and is very extensively employed. When combined with water, in which state it is best known, it was originally, and still is frequently called *oil of vitriol:* first, because it is an oleaginous liquid; and secondly, on account of its being obtained from green vitriol, or copperas, now called sulphate of iron.

This process is still followed at Nordhausen in Germany, and the peculiar compound of sulphuric acid and water produced by it is called Nordhausen oil of vitriol, to distinguish it from common oil of vitriol, a different compound as regards the water which they contain, and obtained by a different process. We shall first describe the original process and product.

Iron pyrites is a well known and very abundant natural substance: it is correctly termed *bisulphuret* of iron, and consists of two equivalents of sulphur 32+28, one equivalent of iron. When certain varieties of this compound are exposed to air and moisture, both the sulphur and iron are oxidized at the expense of the oxygen of the air, and though sulphur by itself is incapable of undergoing this change, yet, when combined with iron, it acquires from the air sufficient oxygen to become sulphuric acid, and the iron attracts enough to become protoxide; and these combining together, and with water, constitute the well-known crystalline body, hydrated sulphate of iron, usually called, for brevity's sake, merely sulphate of iron, and originally green vitriol. This consists of one equivalent of sulphuric acid, one of protoxide of iron, and seven equivalents of water. Sulphuric acid consists of three equivalents of oxygen 24+16, one equivalent of sulphur, =40. In order to procure the acid from it, this salt is moderately heated, so as to expel the greater part of the water: in this state it is put into earthen retorts, and subjected to a very high temperature, during which there comes over and condenses in the receiver a dark-coloured dense fluid, which is the Nordhausen oil of vitriol. The cause of the colour has not been ascertained, but it appears to be an accidental and not a necessary accompaniment: this liquid emits a white vapour when exposed to the air, and hence it is called *fuming sulphuric acid:* it is composed of

Two equivalents of sulphuric acid	80
One equivalent of water . .	9
Equivalent .	89

Now it happens that anhydrous sulphuric acid is more volatile than that combined with water, so that when the above acid is heated in a retort, there first comes over and condenses in the receiver one equivalent of anhydrous sulphuric acid, 40, and there remains in the retort one equivalent of hydrated sulphuric acid 40+9, one equivalent of water, =49.

We shall first and briefly state the properties of the anhydrous acid. It is a colourless crystalline solid; it is tough and elastic; liquefies at 66°, and boils at a temperature between 104° and 122°, forming a transparent vapour, provided no water is present; it unites with moisture when exposed to the air, and forms with it dense white fumes. It is sometimes prepared as a matter of curiosity, but is hardly applied to any use.

The hydrated sulphuric acid, commonly called oil of vitriol, or simply sulphuric acid, is the compound which is so largely employed in numerous chemical operations and manufactures. It is however, and has indeed for many years been, prepared in a much preferable mode to that described by the decomposition of sulphate of iron.

An account of the present method of preparing this acid we shall take, with slight variations, from the last edition of Dr. Turner's 'Chemistry.' Sulphur is mixed with about one-eighth of its weight of nitrate of potash, and the mixture is burned in a furnace so contrived that the current of air which supports the combustion conducts the gaseous products into a large leaden chamber, the bottom of which is covered to the depth of a few inches with water. The nitric acid of the nitre, composed of oxygen and azote, is decomposed, yields oxygen to a portion of the sulphurous acid formed by combustion, and converts it into sulphuric acid which combines with the potash of the nitre, and forms a residue of sulphate of potash. The greater part of the sulphur forms sulphurous acid, by uniting merely with the oxygen of the air during combustion. The nitric acid, on losing oxygen, is converted partly perhaps into nitrous acid, but chiefly into nitric oxide, which, by mixing with the air at the moment of its separation, combines with its oxygen, and gives rise to red nitrous acid vapour. The gaseous substances present in the leaden chamber are therefore sulphurous and nitrous acids, atmospheric air, and watery vapour. Now, when dry sulphurous acid gas and dry nitrous acid gas are mixed together, no action occurs between them; but when a little moisture is added, a white crystalline compound of sulphuric acid, hyponitrous acid, and water is formed; and when this falls into the water of the chamber, it is instantly decomposed, the sulphuric acid is dissolved, and nitrous acid and nitric oxide gases escape with effervescence. The nitrous acid thus set free, as well as that reproduced by the nitric oxide uniting with the oxygen of the atmosphere, is again intermixed with sulphurous acid and moisture, and thus gives rise to a second portion of the crystalline body, which undergoes the same change as the first; and this operation is repeated until the water at the bottom of the lead-chamber is sufficiently acid to be removed for ulterior operations.

It thus appears that sulphur during combustion can combine only with sufficient oxygen to become sulphurous acid; but what is curious is, that sulphurous acid becomes sulphuric acid by taking oxygen from nitrous acid, the nitric oxide of which appears nevertheless to have a stronger affinity for it, since it can take oxygen rapidly from the air, which sulphurous acid cannot. The first attempt at explaining the mode in which nitric acid acts in this operation was made by MM. Clement and Desormes: it was subsequently further explained by Davy and other chemists.

In some cases we believe that the nitrate of potash, instead of being mixed with the sulphur, and burnt with it, is decomposed by the addition of sulphuric acid, in the same mode as that employed for preparing nitric acid. Of late years also sulphuric acid has been made from iron pyrites, the sulphurous acid being formed by combustion, and converted into sulphuric by the agency of nitrous acid.

When the sulphuric acid in the chamber has acquired a density of about 1·6, it is drawn off and further concentrated in open leaden vessels by heat; after this it is again removed either to glass or platina retorts, and heated till it has acquired a density of about 1·845: this is then the sulphuric acid, or oil of vitriol, of commerce, composed of

One equivalent of sulphuric acid .	40
One equivalent of water . .	9
Equivalent .	49

The properties of this acid are, that it is a limpid, inodorous, colourless fluid, of an oily consistence: it boils at about 620°, and distils over unchanged; the boiling-point diminishes with dilution: thus when of specific gravity 1·78 it boils at 435°, and when 1·65 only at 350°, the concentrated acid freezes at −15°, but when it contains two equivalents of water instead of only one, and has a specific gravity of 1·78, it freezes at −40°.

This acid is intensely caustic and acrid, and readily decomposes animal and vegetable fibre, and even when diluted to a very great extent it has an extremely sour taste, and turns vegetable blues strongly red: on the other hand, when concentrated, it turns turmeric-paper of a brownish colour, as the alkalis do, but the effect is not permanent, for it is removed by water. Its affinity for water is very great, attracting it so readily from the air, that in moist weather 3 parts increase to 4 in 24 hours, and by longer exposure the quantity is increased. When suddenly mixed with water, much heat is evolved, and, on cooling, condensation is found to have taken place, the two fluids occupying less space than before mixture. When sulphuric acid is mixed in certain proportions with snow, heat is given out, or cold generated, according to the quantities employed: thus four parts of acid and one of snow evolve heat, but four of snow and one of acid occasion cold.

Sulphuric acid is employed for a vast number of purposes: thus, on account of its great chemical power, it is used for the purpose of separating other acids from bases, as in preparing nitric, hydrochloric, acetic, phosphoric, and carbonic acids, &c. It is used in preparing sulphates, a class of salts we shall presently again refer to.

The salts which sulphuric acid forms with various bases are termed sulphates, sesqui-sulphates, or bi-sulphates, &c.,

according to circumstances: they are a very important class of saline bodies, and those of most use will be found described under their respective bases.

Sulphuric acid in its concentrated state acts in general only slightly, if at all, on the metals; and when they are heated together, the acid is generally decomposed, sulphurous acid and a sulphate of a metallic oxide being produced: thus when copper is heated in concentrated sulphuric acid, the acid yields one of its three equivalents of oxygen to the copper, which becomes protoxide; while the sulphur combined with two equivalents of oxygen is given off in the state of sulphurous acid; and this is one of the best methods of procuring sulphurous acid, it being difficult, if not impossible, as already stated, to saturate oxygen with sulphur by burning the latter in the former. When, on the other hand, sulphuric acid is diluted, it has no action, even when heated, on copper; but on zinc, iron, and such other metals as readily decompose water, it acts with great readiness: the metal, being oxidized by the oxygen of the decomposed water, is dissolved by the acid, while the hydrogen of the water is given out in the gaseous state: by this operation, then, we procure a metallic sulphate and hydrogen gas.

Sulphuric acid and all sulphates are decomposed by the salts of barytes and of lead, minute quantities either of the acid or soluble salts being rendered evident by the formation of a dense white precipitate either of sulphate of barytes or lead; and it is found that 116 parts of the former or 152 parts of the latter sulphate, when dry, indicate 40 parts of anhydrous sulphuric acid.

Hyposulphurous Acid.—In 1817 Dr. Thomson inferred the existence of an acid of sulphur in the salts called *sulphuretted sulphites:* this acid and its compounds have been particularly examined by Sir John Herschel.

Hyposulphurous acid has not been obtained in a separate state, but its composition has been determined to be—

Two equivalents of oxygen	. . .	16
Two equivalents of sulphur	. . .	32
Equivalent	. . . .	48

This acid is procured by dissolving zinc or iron in close vessels in an aqueous solution of sulphurous acid: solution is effected in this acid without the evolution of any gas, which hardly happens in any other case: the metals thus dissolved form crystallizable salts, which, when decomposed by other acids, yield sulphurous acid and sulphur, previously existing in the proportions above stated, and constituting hyposulphurous acid: this acid is also formed when sulphites are digested in close vessels with sulphur, in which case the sulphur takes half the oxygen of the sulphurous acid; and when iron is dissolved in sulphurous acid, it takes half the oxygen of the sulphurous acid, which, by this loss, becomes hyposulphurous acid, and, combining with the oxide of iron formed, they constitute hyposulphite of iron.

The salts containing hyposulphurous acid, or the hyposulphites, are not important; and the acid undergoes decomposition when they are strongly heated or acted upon by an acid.

Hyposulphite of soda is employed to distinguish between the salts of barytes and strontia, the former of which it precipitates, but not the latter: hyposulphite of lime is also a soluble salt. The existence of a hyposulphite in solution is recognised by its possessing the power of dissolving freshly-precipitated chloride of silver, and forming a sweet compound with it.

Hyposulphuric Acid was discovered in 1819 by Gay-Lussac and Welter. It is prepared by suspending finely-powdered binoxide of manganese in water, and passing sulphurous acid gas into the mixture: if this be not kept cold, sulphuric acid is formed; but otherwise the oxide of manganese is dissolved and hyposulphate of its protoxide formed: to the filtered solution sulphuret of barium is to be added, by which sulphuret of manganese is precipitated, and hyposulphate of barytes remains in solution: when the proper quantity of sulphuric acid is added to this, sulphate of barytes is precipitated, and the hyposulphuric acid is liberated, the filtered solution of which is to be evaporated in vacuo over sulphuric acid till it acquires a density of 1·347: if it be carried further than this, it is decomposed into sulphurous acid, which escapes, and sulphuric acid, which remains dissolved.

This acid has not been obtained free from water: the aqueous solution is sour, inodorous, and reddens vegetable blues: if heated to 212°, it is decomposed into sulphurous and sulphuric acids; and when exposed to the air, it slowly absorbs oxygen, and becomes sulphuric acid. Unlike sulphuric acid, it forms soluble compounds with lime, barytes, strontia, and oxide of lead; but, like diluted sulphuric acid, it acts upon and dissolves zinc, with the evolution of hydrogen gas, and a solution of hyposulphate of zinc is formed: its salts are decomposed at a high temperature, yielding sulphurous acid and sulphates remaining.

It is composed of—

Five equivalents of oxygen	. . .	40
Two equivalents of sulphur	. . .	32
Equivalent	. . . .	72

It is therefore equal to a compound of one equivalent each of sulphurous and sulphuric acid, which explains why, when it is heated, it is converted into these two acids.

Azote and Sulphur.—No compound of these elements is known.

Hydrogen and Sulphur combine in two proportions, forming hydrosulphuric acid, frequently called sulphuretted hydrogen gas, and bisulphuret of hydrogen.

Hydrosulphuric acid, formerly known by the name of hepatic gas, exists in sulphurous waters, such as those of Harrowgate: it is stated by some authors, but denied by others, that it may be formed, to a certain extent, by heating or subliming sulphur in hydrogen gas. It is usually produced by the action of hydrochloric acid on sulphuret of antimony, or by acting upon protosulphuret of iron with dilute sulphuric acid: in the former case the hydrogen of the hydrochloric acid unites with the sulphur of the sulphuret, chloride of antimony being also formed; while in the latter, the decomposed water yields hydrogen to the sulphur and oxygen to the iron, which, being then dissolved by the acid, constitutes sulphate of iron. As it is scarcely possible to combine the whole of any given quantity of iron with sulphur, the uncombined portion yields a little free hydrogen with the hydrosulphuric acid; but this, in most cases, is of no consequence: although hydrosulphuric acid is, to a certain extent, soluble in water, yet the gas may for most purposes be received in vessels filled with it.

The properties of hydrosulphuric acid are, that it is colourless, and gaseous at common temperatures and pressures: it has a peculiarly nauseous and fetid odour, resembling that of putrid eggs; its taste is also extremely disagreeable. Its specific gravity is about 1·18: 100 cubic inches weigh about 36·55 grains.

It is composed of—

One equivalent of hydrogen	. .	1
One equivalent of sulphur	. . .	16
Equivalent	. . . . .	17

Or it may be regarded as consisting of 100 cubic inches of hydrogen gas, holding 34·4 grains of sulphur in combination, the gas, by combining with the sulphur, undergoing no alteration of colour. It reddens moist litmus-paper, but not strongly, and is soluble in about one-third of its bulk of water. At a temperature of 50°, and under a pressure of about 17 atmospheres, it is rendered a limpid liquid, of specific gravity about 0·9: this does not congeal when cooled down to 0. It is extremely poisonous to animals: air containing 1-1500th of its bulk immediately killed a bird, and 1-1000th a middle-sized dog. When mixed and detonated with oxygen gas, the results are water and sulphurous acid.

The aqueous solution of hydrosulphuric acid is employed as a test of metals, and, more especially, it is an excellent substance for the discovery of minute portions of lead, with which it gives a dark-coloured precipitate of sulphuret of lead: with the salts of antimony it gives an orange precipitate, and with arsenious acid a yellow one.

Hydrosulphuric acid forms salts which are termed *hydrosulphates*, and these are probably formed when it is combined with ammonia, potash, soda, and the alkaline earths; but by metallic oxides, properly so called, it is decomposed, the results not being hydrosulphates of metallic oxides, but water and a metallic sulphuret: this is the case with oxide of lead, silver, &c.

Bi-sulphuret of Hydrogen.—This compound cannot be formed by direct combination. To prepare it, equal weights of sulphur and recently slacked lime may be boiled in three times their weight of water for half an hour. The result is a deep reddish-yellow coloured solution of persulphuret of calcium: when clear and cold, it is to be added to an excess

of hydrochloric acid diluted with about twice its weight of water: by their mutual action sulphur is precipitated, accompanied with a yellow oil-like fluid, which is the bi-sulphuret of hydrogen. Its properties are, that it is a viscid liquid, of a yellow colour, and of specific gravity about 1·77; its smell is similar to, but not so powerful as that of hydrosulphuric acid; its elements are held together by a feeble affinity, so that even in the cold it is gradually converted into hydrosulphuric acid and sulphur, and this change is immediately produced at 212°.

It is composed of—

One equivalent of hydrogen . .	1
Two equivalents of sulphur . .	32
Equivalent . . .	33

Chlorine and Sulphur appear to form two compounds, the chloride and di-chloride. According to Dumas, when sulphur is acted upon by excess of chlorine, a neutral chloride is obtained, which consists of—

One equivalent of chlorine . .	36
One equivalent of sulphur . .	16
Equivalent . . .	52

It usually contains some di-chloride, from which it is to be purified by repeated distillation at about 140° Fahr.

It may be formed either by heating sulphur in excess of dry chlorine gas, or, at common temperatures, by passing excess of chlorine through a tube containing powdered sulphur.

The properties of this chloride are, that it is liquid, has a reddish-brown tint, and a density of 1·62; that of its vapour being about 3·7. Its boiling-point is 147°.

Di-chloride of Sulphur.—This substance was first obtained by Dr. Thomson. When chlorine gas is passed over powdered sulphur, gently heated, it gradually disappears, and the di-chloride is formed by direct combination: the liquor obtained is to be distilled, and then possesses the following properties:—It is liquid, and is red by reflected, and yellowish-green by transmitted light: it emits acrid fumes when exposed to the air; its density is 1·687, that of its vapour being 4·7; it is volatile below 200°, and boils at 280°. Dry litmus-paper is not altered by it. It is energetically decomposed by and decomposes water, the results being hydrochloric and hyposulphurous acids. It does not combine with alkalis.

It consists of—

One equivalent of chlorine . .	36
Two equivalents of sulphur , .	32
Equivalent . . .	68

Sulphur and Bromine. [BROMINE.]

Having described the principal compounds which sulphur forms with the elementary gaseous bodies, we shall briefly notice those which it yields by combination with the non-metallic elementary solids, and first—

Carbon and Sulphur.—These form by direct action sulphuret of carbon, or rather bi-sulphuret.

It may be obtained either by passing the vapour of sulphur over charcoal heated to redness in a porcelain tube, or distilling a mixture of bi-sulphuret of iron and one-sixth of its weight of charcoal. It may be condensed by being passed into cold water, and to free it from uncombined sulphur and moisture it should be rectified from chloride of calcium at a low temperature.

Its properties are, that it is a colourless transparent liquid, of density 1·272, that of its vapour being 2·668; it has an acrid pungent taste, and a very fetid odour; its refractive power is very high; it is insoluble in water, but combines with alcohol and æther, from which water precipitates it; it is extremely volatile, boils at about 110°, and is not rendered solid at − 60°: owing to its great volatility, it produces sufficient cold under the exhausted receiver of the air-pump to freeze mercury: it is extremely inflammable, the results of its combustion being carbonic and sulphurous acid gases, attended with a brilliant greenish-white flame.

It is composed of—

One equivalent of carbon . .	6
Two equivalents of sulphur . .	32
Equivalent . . .	38

It is a remarkable circumstance that so volatile a liquid should be produced by the combination of two solid bodies. It was discovered by Lampodius in 1796.

Phosphorus and Sulphur. [PHOSPHORUS.]

Iodine and Sulphur. [IODINE.]

Selenium and Sulphur.—[SELENIUM.]

Boron and Sulphur form sulphuret of boron.

According to Berzelius, when boron is heated to whiteness in the vapour of sulphur combustion takes place, with a red flame, and these substances appear to combine in more than one proportion, but their properties have been very imperfectly ascertained.

Sulphur combines also with various compound bodies to form very different substances: some of these we shall briefly mention.

Sulphur and Cyanogen, when made to unite by heating a mixture of sulphur and bi-cyanide of mercury, and by some less direct processes, produce *sulphocyanogen*, or *cyanide of sulphur.* It is a yellow powder, insoluble in water, alcohol, and æther, but dissolves in hot sulphuric acid, from which water precipitates it; concentrated nitric acid decomposes it.

It appears to be composed of—

Two equivalents of sulphur . .	32
One equivalent of cyanogen . .	26
Equivalent . . .	58

Sulphocyanic Acid; Hydrosulphocyanic acid; Sulphocyanhydric Acid. When subsulphocyanide of lead is decomposed by dilute sulphuric acid, or sulphocyanide of silver diffused through water is decomposed by hydrosulphuric acid, sulphocyanic acid is formed; and when purified, it is a colourless liquid, easily decomposed by exposure to air or heat; chlorine also decomposes it, by combining with its hydrogen, and evolves cyanogen. It reddens the solutions of the persalts of iron, exists in the seeds of the cruciferous plants, and in the saliva of man and the sheep.

It consists of—

One equivalent of sulphocyanogen	58
One equivalent of hydrogen . .	1
Equivalent . . .	59

Sulphonaphthalin; Sulphonaphthalic Acid.—This compound was obtained by Faraday from the action of sulphuric acid upon naphthalin; the operation is tedious. Its properties are, that it is crystalline, readily soluble in water and in alcohol; when strongly heated, it is decomposed, at first with the production of napthalin, sulphurous acid, and charcoal; it reddens moistened litmus-paper powerfully, and has an acid bitter taste; it combines readily with alkalis, forming salts which are called *sulphonaphthalates:* these are soluble in water, and most of them in alcohol, and when heated in the air, they burn, leaving sulphurets or sulphates, according to circumstances; it is probably a direct compound of sulphuric acid and naphthalin. Its elementary composition is stated to be—

Twenty equivalents of carbon	. 120
Eight equivalents of hydrogen	. 8
Two equivalents of sulphuric acid	. 80
Equivalent . . .	208

Sulphovinic Acid.—An acid produced by the action of sulphuric acid upon alcohol, and, according to Mr. Hennel, a necessary intermediate substance in the formation of æther. He found that when two equivalents of sulphuric acid and two of alcohol were merely mixed, the acid immediately lost four-sevenths of its power of precipitating oxide of lead, and, undergoing great change of properties, was converted into the acid in question, and composed of—

Two equivalents of sulphuric acid	. 80
Two equivalents of alcohol .	. 46
Equivalent . . .	126

When an equivalent of this acid is heated, it is decomposed: the two equivalents of sulphuric acid, and one equivalent of water, remain in the retort, while the other elements form an equivalent of æther.

Sulphovinic acid may be procured in solution by accurately decomposing sulphovinate of lead with dilute sulphuric acid; but it has not been obtained in a dry state, except when combined with a base.

Several of the sulphovinates are crystallizable salts, but they are not applied to any particular use.

Sulphur Salts.—These are certain double sulphurets, so designated by Berzelius: the electro-negative sulphurets, constituting *sulphur acids;* and the electro-positive sul-

phurets, *sulphur bases*. Among the sulphur acids are the sulphurets of arsenic, antimony, tellurium, tin, &c.: and in this class he also includes sulphuretted hydrogen, sulphuret of carbon, and selenium and sulphocyanogen: the sulphur bases include the protosulphurets of the metals of the alkalis and alkaline earths.

SULPHUR is an elementary principle which occurs in great abundance in the mineral, sparingly in the vegetable, and still more sparingly in the animal kingdom. In the vicinity of volcanoes sulphurous fumes issue copiously from the ground, and many mineral waters owe their peculiar odours and much of their virtues to sulphurous impregnations. Plants which contain it have often an offensive smell, to which most probably it contributes, such as assafœtida, garlic, and mustard [SINAPI], in which last it occurs as a constituent of myronic acid, a portion of which probably attaches to the volatile oil of mustard, the odour of which is stronger and more offensive than that of garlic and assafœtida combined. In animals it occurs in conjunction with albumen, and hence white of egg blackens silver egg-spoons.

For medical purposes, it should be as pure as possible, but in the two forms in which it occurs it is seldom perfectly free from admixture. Sublimed sulphur (flowers of sulphur) generally contains some sulphuric acid, which renders it slightly pungent; and precipitated sulphur, or milk of sulphur, mostly contains sulphate of lime. Of the two forms, precipitated sulphur, owing to the extremely fine state of subdivision in which it exists, is in equal quantities more powerful than the sublimed.

Sulphur is insoluble in alcohol, but soluble in oils, both fixed, such as linseed, and volatile, such as turpentine; with the former of which it forms the *balsamum sulphuris simplex*, with the latter the balsamum sulphuris *terebinthinatum*.

Though devoid of any marked sensible qualities, sulphur acts as a stimulant to the living tissues. Applied to the sound skin, it seems to have no effect upon it, but placed in contact with an ulcerated surface, it irritates and excites an inflammatory action. Large doses, such as a pound, given to horses, prove fatal by producing violent inflammation, recognisable during life by the symptoms, and after death by the morbid appearances. These may not have been due entirely to the sulphur, but to the sesqui-sulphuret of arsenic (orpiment), with which sulphur is often contaminated. Hence the increased redness and sensibility of parts affected with cutaneous eruptions when sulphur is applied to them. It is clear therefore that it is by exciting to new action the unhealthy structures that it effects a cure of these diseases, and not by causing a repulsion or transfer of it to some other quarter, though this not unfrequently follows the too rapid healing of such complaints, if they have been spread over a large surface. Taken internally, sulphur gives rise to two distinct orders of effect: the one, its action on the intestinal canal; the other, upon the system generally. Small doses, if they do not increase the digestive power, at least do not disturb it; but larger cause a disagreeable sensation in the epigastric region, followed by alvine dejections, which are generally gentle, and without colic or griping. When it causes alvine evacuations, it does not produce marked general effects; but when given in small doses, with a sufficient interval between each to favour its absorption, its general action is commonly very apparent. The pulse becomes more frequent, the animal heat and perspiration are increased, and the presence of sulphur may be recognised in all the excretions of the body, or a transudation of it in the form of hydrosulphuric acid (sulphuretted hydrogen). In this way silver worn in the pocket of a person using sulphur becomes blackened.

The long-continued use of it gives rise to still more obvious stimulant effects. General excitement of the system takes place, increased arterial action leads to hæmorrhages, &c., accompanied by restlessness, sleeplessness, and thirst. The appearance of these symptoms should point out the propriety of suspending its further use till they can be removed by antiphlogistic means.

Sulphur should not be used for very plethoric individuals, or those inclined to high vascular action, till those states have been lessened by diet and other means.

Internally sulphur has been given in chronic catarrhs and humid coughs, as well as in some of the forms of asthma. In these some of the numerous combinations with oils and other substances, called balsams of sulphur, were chiefly used. From the power which sulphur undoubtedly possesses over mucous membranes, especially the bronchial, these were often serviceable; but in the asthmatic affections complicated with organic disease of the heart or great vessels, nothing can be more hurtful.

In chronic rheumatism sulphur, from its diaphoretic properties, is of much utility either alone or with antimonials. In those forms of dysentery which may be regarded as rheumatism of the intestines, sulphur is perhaps the best aperient in combination with ipecacuanha. It is also beneficial in those forms of paralysis which have resulted from rheumatism. It is stated to effect a cure of intermittents, and considering its power of rousing the vascular system, and its subsequent diaphoretic action, it may be used in those cases where arsenic fails and quinine is too expensive.

Sulphur is given as a laxative in hæmorrhoids, stricture of the rectum, and habitual constipation. For these cases it is usually combined with bi-tartrate of potash, or magnesia, or electuary of senna. A small quantity of the compound cinnamon-powder, or aromatic confection, is a valuable addition, as it lessens any tendency to griping, and also restrains the disposition to the disengagement of sulphuretted hydrogen gas, which is often a distressing consequence of the use of sulphur. The dose varies much in different individuals, but in all cases it should be ample, as an inefficient quantity is most prone to generate flatus. Persons of a sedentary habit, afflicted with constipation, find this combination of unspeakable service, as, unlike many others, it is not followed by greater constipation than before, but keeps the bowels moderately open for a considerable time. It is one of the most appropriate medicines for children or pregnant females.

Sulphur is generally given internally at the same time that it is used externally for the cure of cutaneous diseases. For one of these (*scabies*) it is regarded as almost a specific. Sulphur ointment is the form generally employed for this disease. It should never be applied to more than a fourth part of the body at one time. The compound sulphur ointment is more powerful, but requires still more caution in its employment from the veretrine it contains. In workhouse practice, the preferable mode of employing sulphur is by uniting it with soft-soap, which not only does not stain and grease the clothes, but assists in cleansing them as well as the patients, when washed. Besides, the potash of the soap aids the cure. Many cutaneous diseases are more readily cured by a condensation of sulphur with potash than by either singly. This combination, called Potassii sulphuretum, or liver of sulphur, may be applied in various ways, particularly in baths, forming artificial Harrowgate-water. The natural waters of Harrowgate, Moffat, and other sulphurous springs, owe their peculiarities to it.

Sulphur in combination with iodine, forming ioduret of sulphur, when made into an ointment with a large quantity of lard or cerate, is a valuable agent in some cutaneous diseases.

Sulphur in a state of combustion evolves sulphurous acid gas. This is sometimes employed as a fumigation in some obstinate cutaneous affections, especially psoriasis inveterata, which often continues about the joints, especially the elbow, when it has been cured in every other part. The employment of this requires caution, and on no account must the face be exposed to it, as it is irrespirable.

SULPHUR TRADE. Although sulphur exists in Iceland, Teneriffe, St. Vincent's, and some other places, the expense of obtaining it is so great, that Sicily alone has furnished the supply required. The average consumption of England in the five years, from 1820 to 1824, was 7080 tons. In 1825 the duty was reduced from 15*l.* to 10*s.* a ton, and in the following ten years the annual consumption averaged 15,140 tons; and during the last four years of this period the average was 32,000 tons. In 1837 it amounted to 37,486 tons. The consumption of Sicilian sulphur in France, which was nearly stationary from 1825 to 1833, and averaged 11,844 tons, increased 57 per cent. during the next five years to 1838, averaging 18,625 tons. In 1840 the importation into France reached 40,618 tons, and the stock in bond amounted to 27,495 tons: in October, 1838, the quantity in bond in the United Kingdom was 20,319 tons; so that in both countries the importation had greatly exceeded the wants of the home market. From 1833 to 1838 England took 49 per cent. of the whole quantity of sulphur exported from Sicily, and France 43 per cent., leaving only 8

per cent. for all other countries; and part of this was shipped for Malta, and eventually reached England. The sulphur trade gave employment to 30,000 tons of British shipping.

The Sicilian sulphur-mines are the property of individuals, and from fifteen to twenty English firms settled in Sicily are engaged in the trade. In 1836 M. Taix, a Frenchman, laid before the Sicilian government a project for establishing a company which was to have the exclusive right during ten years of purchasing Sicilian sulphur at fixed prices, on condition of spending 10,000*l.* a year in constructing roads, and exporting one-third of the quantity produced in Sicilian vessels. The British merchants becoming alarmed, the Sicilian government, in reply to the British ambassador, stated that no such project would be adopted. It would have been in direct contravention to certain commercial treaties between the two governments. The Sicilian government did however enter into a contract with M. Taix, and on the 4th of July, 1838, notice was given at Palermo that the monopoly would come into operation on the 1st of August ensuing. The negociations respecting this monopoly were conducted with great secrecy, and it came into operation so suddenly that twenty-four vessels lost their cargoes. The British lessees of mines, and all others, were compelled to produce only a fixed quantity of sulphur; prices rose from 6*l.* 10*s.* or 7*l.* to 13*l.* and 14*l.* per ton, and contracts could not be completed. Previous to the monopoly 484 British vessels sailed from the ports of Sicily to the United Kingdom; but in the first fifteen months after the monopoly the number was only 157. The importation of sulphur, which was 44,653 tons in 1838, was only 22,160 tons in the year ending 10th October, 1839, of which only 5400 were brought direct from Sicily. A cargo was brought from Iceland. At length the British government took very decided steps to put an end to a monopoly established in the face of commercial treaties: the coasts of Sicily and Naples were blockaded by our ships of war; and the Sicilian government, no longer daring to uphold the monopoly, accepted the mediation of the king of the French in adjusting the dispute with the British government. The monopoly was abolished in July, 1840, and a mixed English and Sicilian commission was appointed in November to investigate the claims of British subjects whose interests had been injured by it. The claims amounted to 65,610*l.*, of which 21,307*l.* were awarded; and as it was stipulated that the awards should bear interest at the rate of six per cent. so long as they remained unsettled, the Sicilian government agreed, in January, 1842, to pay them without any delay. The sulphur trade is now placed on the same footing as before the 4th of July, 1838.

(*Sulphur Trade of Sicily*; *Journ. of Statistical Society*, vol. ii., part 6; *Papers relative to the Sulphur Question*, presented to the House of Commons, February, 1842.)

SULPHURIC ACID. (Chemistry.) [SULPHUR.]

SULPHURIC ACID, MEDICAL PROPERTIES OF. This, which is regarded as the most potent of the mineral acids, is never taken internally in a concentrated state except by accident, or with the intention to commit suicide or murder. In such cases it acts as a violent corrosive poison, causing complete disorganization of the tissues it comes in contact with, its course being obvious from the black and charred state of the parts. This effect it is thought to produce from its strong affinity for water, depriving the tissues of its elements, and leaving the carbon free. This peculiarity distinguishes poisoning by it from the other mineral acids. Notwithstanding the extensive destruction of important organs, such as the stomach, immediate death rarely results from it, but the patient lingers sometimes for days, and in some cases ultimately recovers.

Sulphuric acid is sometimes employed in an undiluted state as a caustic application to the bites of rabid animals, or to destroy warts or portions of the eyelids in entropium and ectropium.

In a considerably diluted state, if it be applied to the skin, it occasions a painful impression, followed by numbness and a contraction of the parts, and even whiteness, owing to the diminished calibre of the capillaries. But shortly the afflux of blood to the part recurs, and soon increases, so that the action of the vascular system appears to become more developed than before. As it is presumable that a similar series of actions takes place when received in a diluted form into the stomach, by bearing these phenomena in mind it is possible to explain its therapeutic influence in many of the cases where it is used.

Taken internally in a diluted but still strong state, it makes a powerful impression on the stomach, followed by an instantaneous sympathetic chill of the whole system: hence its power in checking hæmorrhage long before its particles can be received into the circulation and constringe the vessels by immediate contact with their sides. From the same cause it acts as a useful refrigerant in fevers and other inflammatory diseases when the animal temperature is too high. In many of the transient diseases of the skin attended with much heat and itching, a solution of sulphate of magnesia, with an addition of dilute sulphuric acid, quickly relieves them. It has also been given at a late stage of typhus in some mild diluent, such as barley-water. In combination with cinchona, it is of decided utility in purpura hæmorrhagica. Nothing so certainly checks the colliquative sweats which attend hectic fever as the compound infusion of roses. In chronic diarrhœa and dysentery it is also sometimes of service. Hæmorrhoidal fluxes are often restrained by its use. In some forms of dyspepsia it is a valuable tonic, and may be longer persevered with than any other mineral acid except phosphoric. In calculous diseases with a phosphatic diathesis, it is much to be commended, from the length of time it can be used. In such cases it is best given in infusion of chamomile made with cold water. It is employed largely diluted as a gargle in the sore-throat of scarlet fever. Many cases of cutaneous diseases have been cured by the internal use of sulphuric acid. The aromatic sulphuric acid, called elixir of vitriol, has more tonic properties than the simple acid. A few drops of it, ten or twelve, in a cup of cold water, relieve very certainly the squeamishness of the stomach which is felt in the morning after an excess of wine. In case of poisoning by sulphuric acid, lime-water, calcined magnesia, or plaster from the wall, or a solution of soap, should instantly be given.

The unguentum acidi sulphurici is a most effectual application in obstinate cases of itch. It chars the linen.

SULPHUROUS ACID. [SULPHUR.]

SULPI'CIA, a Roman poetess, of whose productions we possess only one Satire, consisting of seventy verses, which is usually called 'De Edicto Domitiani, quo Philosophos Urbe exegit.' She is generally supposed to be the same as the Sulpicia mentioned by Martial (x. 35 and 38), and to have been the wife of Calenus: she was accordingly a contemporary of Domitian and of Martial. The poem of Sulpicia is on the whole stiff, and shows little imagination. It is usually annexed to the editions of Persius and Juvenal; the best separate edition is that by J. Gurlitt, 'Cum Commentariis C. G. Schwartzii,' 2 parts, 4to., Hamburg, 1819. It is also printed in the 'Anthologia Latina' of Burmann, and Wernsdorf, 'Poetae Latini Minores.'

(Burmann, *Antholog. Lat.*, ii., p. 408, &c.; Wernsdorf, *Poet. Lat. Min.*, iii., p. lx., &c., and p. 83, &c.)

In the fourth book of the 'Elegies' of Tibullus there are several letters written in the name of Sulpicia, which in their character and diction present some slight differences from the other poems of Tibullus. Some modern critics, as Barth (*Adversaria*, lix. 16) and Brouckhuis (ad Tibull., p. 384), have therefore supposed that they were written by the Sulpicia above mentioned. This opinion however cannot be reconciled with several historical allusions in these letters, which clearly point to the age of Augustus. For this reason Heyne (ad Tibull., iv. 2, p. 350, &c.) conjectured that they were the work of a Sulpicia who lived in the time of Tibullus. But this opinion too rests on very weak grounds, and we cannot indeed see any sufficient reason for supposing that these letters, notwithstanding their slight peculiarities, were not written by Tibullus himself.

(Compare Bähr, *Geschichte der Röm. Literatur*, p. 250 and 279.)

P. SULPICIUS RUFUS was born in the year B.C. 124, and was ten years older than the orator Hortensius. In the year B.C. 94 he prosecuted C. Norbanus for the offence of majestas, under the provisions of the Lex Apuleia, a circumstance which brought him into notice. (Cic., *Off.*, ii. 14.) In the following year he was quaestor, and he served in the Social war as legate of Cn. Pompeius Strabo. He was tribunus plebis in the year B.C. 88, and supported the faction of Marius. Cicero heard many of his speeches during his tribunate, and thoroughly studied his style of oratory: 'He was,' says Cicero, 'of all the orators that I ever heard, the most dignified, and, if one may use the expression, the most tragic: his voice was powerful, sweet, and clear; his gesture and every movement graceful; and yet he seemed as if he were trained for the forum, and not for

the stage: his language was rapid and flowing, and yet not redundant or diffuse.' (Cic., *Brut.*, 55; comp. Cic., *De Orat.*, iii. 8.) Among other measures of his tribunate, Sulpicius brought forward and carried a rogatio, by which the command of the Mithridatic war was transferred from Sulla to Marius. Sulla, who was then at Nola with his army, marched to Rome, of which he took possession. [SULLA.] Twelve persons were proscribed, among whom were Marius and Sulpicius. Marius escaped; but Sulpicius was betrayed by his slave, and murdered in a villa near Rome.

Sulpicius left no writings, and Cicero states that he had often heard him say that he was not accustomed to write, and that he could not write. (*Brut.*, 56.) There were however orations attributed to him, but they were supposed to be the work of P. Canutius. P. Sulpicius is one of the interlocutors in Cicero's dialogue 'De Oratore.'

It does not appear how P. Sulpicius was related to Servius Sulpicius Rufus. As he was a tribune, he must have been of a plebeian family, or at least must have been adopted into a plebeian family, and it may be that he was of a different family from Servius Sulpicius.

SULPICIUS LEMONIA RUFUS, SERVIUS, the friend and contemporary of Cicero, was nearly about the same age as Cicero (*Brut.*, 40), and consequently was born about B.C. 106. He was of a patrician family, and yet Cicero says that his father was only an eques. He began his career as an orator, and might have attained the first place or have been only inferior to Cicero, if he had not directed his energies to the study of the law. It is said that on one occasion he applied to Q. Mucius Scaevola the Pontifex for his advice on a question of law, and that Scaevola, perceiving Servius did not understand what he said, reproached him for his presumption in undertaking the conduct of causes, when he was ignorant of the law which was necessarily involved in them. This determined him to devote himself to the law. The time at which Servius began his legal studies does not appear. He accompanied Cicero to Rhodes, B.C. 78 (*Brut.*, 41), and it may be inferred from the passage of the 'Brutus' that he commenced his legal studies after his return, or perhaps it was after his return that he devoted himself exclusively to the law. His object in visiting Rhodes was to improve himself.

Servius filled several public offices. He was quaestor of the district of Ostia (Cic., *Pro Muren.*, 8), curule aedile, and praetor for Quaestiones Peculatus. The first time that he was a candidate for the consulship he was rejected, and L. Murena was elected, whom Servius prosecuted for ambitus (bribery): Murena was defended by Hortensius, M. Crassus, and Cicero. In the year B.C. 51 he was elected consul with M. Claudius Marcellus, in preference to Cato, who was rejected. In the year preceding his consulship he had been interrex, in which capacity he returned Cn. Pompeius as sole consul. In the war between Cæsar and Pompey he does not appear to have taken any decided part, though it seems probable that he most inclined to Cæsar's side; at least, after the defeat of Pompey at Pharsalia, Cæsar made him governor of Achaea, where he was at the time when Cicero addressed to him one of his extant letters (*Ad Div.*, iv. 3). During the residence of Sulpicius at Athens, his former colleague Marcellus was assassinated in Piraeus; Sulpicius had him honourably buried in the gymnasium of the Academia, where a marble monument was erected to his memory. This tragical event is communicated by Sulpicius to Cicero in an extant letter, which is characterised by great simplicity. After the death of Cæsar he was sent by the senate, with L. Philippus and L. Piso, on a mission to Antony, who was then besieging D. Brutus in Mutina, for the purpose of negotiating with Antony before the senate declared him an enemy to the state. He was then in bad health, and only just lived to reach the camp of Antony, where he died, B.C. 43. Cicero pronounced a eulogy on his friend in the senate, and on his motion a bronze statue was erected to the memory of Servius, which existed for some time. (Cic., *Phil.*, ix.; *Dig.*, i., tit. 1, s. 2, § 43.) The terms of the senatus consultum, which was drawn up by Cicero (*Phil.*, ix. 7), included the honours of a public funeral. He left a son, Servius, who is mentioned by Cicero: his wife's name was Postumia. (Cic., *Ad Div.*, iv. 2.) The fourth book of Cicero's letters (*Ad Diversos*) contains his letters to Sulpicius and two letters from Sulpicius to Cicero.

Servius was an accomplished man, as well as a distinguished orator; but as a lawyer he was, in the opinion of Cicero, pre-eminent and unrivalled. His teachers were L. Lucilius Balbus and C. Aquilius Gallus. Cicero (*Brut.*, 41) attributes his excellence as a lawyer to the philosophical discipline which he had undergone. He observes that others possessed a knowledge of the law, but Servius alone possessed it as an art. This art, he adds, he could never have derived from mere knowledge of the law; but he had acquired that dialectic skill, the greatest of all arts, which enabled him to dispel the obscurity that characterised the responsa and speeches of other lawyers. 'He distributed the matter of a thing into its parts, he developed by definition what was latent, he cleared up what was obscure by correct interpretation: he first ascertained and then separated what was ambiguous; lastly, he had a measure by which to estimate truth and falsehood, and to determine what consequences followed and what did not follow from premises.' To these acquirements and to a profound knowledge of the law he added an acquaintance with letters and an elegant diction. Such a combination of talent seldom appears.

Servius was a voluminous writer. Cicero speaks of his works as being unequalled. We may judge of his style from his letter of consolation to Cicero on the death of his daughter Tullia. (Cic., *Ad Div.*, iv. 5.) He wrote nearly a hundred and eighty treatises on law, many of which existed in the time of Pomponius, that is, in the time of Antoninus Pius. He probably wrote a commentary on the Twelve Tables: he was also the author of a treatise on the Edict, and notes on a work on the civil law by Q. Mucius Scaevola the Pontifex (Gell., iv. 1); of a book 'De Dotibus,' and several books 'De Sacris detestandis' (adoption, probably). There are extant various fragments of his belonging to treatises the titles of which are not known. He is often mentioned in the 'Digest,' particularly by Alfenus, but there is no excerpt from his works in that collection. It seems a probable conjecture that when Alfenus quotes another person without mentioning a name, his master Servius Sulpicius is meant. (Bynkershoek, *Observ.*, viii. 1.)

Servius founded a numerous school of lawyers, but we are only acquainted with the names of those who were known as writers. His most celebrated pupils were Alfenus Varus and Aulus Ofilius: there were also among others Aufidius Tucca, C. Ateius Pacuvius, and Antistius Labeo, the father of a more distinguished son.

Our information about Servius Sulpicius is mainly derived from his friend Cicero, who gives him a high character for integrity. He is said to have written some erotic poems. (Ovid., *Trist.*, ii. 1, 141; Plin., *Ep.*, v. 3.)

SULPI'CIUS, SEVE'RUS, a Christian writer belonging to the end of the fourth and the beginning of the fifth century of our æra. He is generally supposed to have been born about the year A.D. 366, in Aquitaine, and was descended from a distinguished family. He first followed the legal profession, and gained great reputation as an orator; but after the death of his wife, who belonged to a consular family, and died at an early age, Sulpicius withdrew himself entirely from the world, and with a few friends led a retired and monastic life as a presbyter in Aquitaine. He commenced this life about A.D. 392, at the same time that his intimate friend Paulinus adopted the same mode of life, who, in his letters commends Sulpicius for his conduct, and the more as the father of Sulpicius had disinherited his son for the step he had taken. (Paulin., *Epist.*, v. 1; xi. 5; xxiii. 3, &c.) But what Sulpicius thus lost through the anger of his father, was amply made up by the munificent liberality of his father-in-law. Sulpicius made several journeys to Tours, the bishop of which place, Martinus, inspired him with such admiration, that Sulpicius, who gradually formed an intimate friendship with him, resolved to become his biographer. Further particulars respecting the life of Sulpicius are not known, except that during his last years he abstained altogether from speaking, as he considered his former habits to have been rather loquacious, for which he meant to atone by perfect silence. (Gennadius, *De Viris Illustr.*, 19.) The time of his death is very uncertain: some assign it to 420, others to 422, and others again to 432; but the most probable opinion is that he died about A.D. 410, or soon after.

We possess of Sulpicius Severus four different works: 1. 'Vita Sancti Martini Turonensis,' which is written in the panegyrical style, and is full of miraculous events in the life of his hero. It was however not published till after the

death of Martinus, about A.D. 400. The work is preceded by an epistle 'Ad Desiderium Fratrem,' and at the end of it there are three letters describing the death, burial, and those virtues of Martinus which were not sufficiently set forth in the biography itself. 2. 'Historia Sacra,' or 'Chronica Sacra,' in two books. This is a brief history of religion from the creation down to the consulship of Stilicho and Aurelian (A.D. 400). The first book and the first twenty-six chapters of the second treat of the history of the Jews; and the remaining portion chiefly contains accounts of the life of Christ, the persecutions of Nero, the history of Constantine, and in general of the most important events in the early history of Christianity. Here too, as in his Life of Martinus, the author shows a great partiality for what is marvellous. 3. 'Dialogi Tres,' or it should rather be 'Dialogi Duo,' as the second dialogue is only a part of the first: the principal object of these dialogues is to describe the merits and virtues of the monks and hermits of the East. 4. 'Epistolae,' the genuineness of some of which is very doubtful.

Notwithstanding the superstitious tone which pervades all the works of Sulpicius, they have a charm arising from their purity of diction which scarcely any other writer of this age possesses. His language is clear and concise, and he seems to have taken Sallust as his model in this respect. Some writers have therefore called him the Christian Sallust.

His 'Vita Martini' has often been printed. The editio princeps of his 'Historia Sacra' appeared at Basel, 1556, 8vo.; it was followed by the editions of Sigonius with a commentary, Bononiae, 1581, 8vo.; and of J. Drusius, Arnhemi, 1607, 8vo. A collection of his works appeared under the title 'Severi Opera emendata et illustrata à V. Giselino,' Antwerp, 1574, 8vo., and Paris, 1575, fol. The latter however only contains his 'Vita Martini' and the 'Historia Sacra.' Other editions of all the works of Severus are those by G. Horhius, Lugdun. Bat., 1647, 1654, 1665, 8vo.; by J. Vorstius, Berolini, 1668, 12mo., Lipsiae, 1703, 1709, in 8vo. The best edition is that by Hieronymus de Prato, Veronae, 1741 and 1754, 4to., which however does not contain the letters. His works are also printed in the 'Bibliotheca Patrum Max.,' Lugdun., vol. vi., p. 324, &c., and in Galland's 'Bibliotheca Patrum,' vol. viii., p. 355, &c.

(G. Vossius, *De Historicis Latinis*, p. 209, &c.; Bähr, *Geschichte der Röm. Lit.*, 2te abtheil, *Die Christlich-Römische Theologie*, p. 219, &c.)

SULTA'N, an Arabic word meaning 'a despotic ruler, or a man who is the arbiter of the life and property of a set of men.' It is the usual title of royalty among the Arabs and Turks. From sultán the Italians have made their *soldano*, and the Spaniards have their *sultán*. The lawful wife of a sultán, who has children by him, is called by us a sultana.

SULTANIYAH. [PERSIA, p. 476.]

SULZER, JOHANN GEORG, the youngest of a family of twenty-five children, was born October 16th, 1720, at Winterthur, in the canton of Zürich, where his father held the office of 'Seckelmeister,' or registrar of public accounts. Losing his parents, both of whom died on the same day, while he was yet in early youth, it was with difficulty that he was enabled to pursue his education for the church, according to their wishes, but with little inclination on his own part. In 1736 he was placed at the gymnasium at Zürich, and immediately on quitting it, three years afterwards, was ordained and became curate to the pastor of Maschwanden. Ill health however soon compelled him to resign his clerical duties, nor did he ever re-assume them. He now returned to his first and favourite studies of natural history, mathematics, and philosophy, and after residing about four years at Magdeburg as private tutor in the family of a wealthy merchant, received the appointment of professor of mathematics at the Joachimsthal gymnasium, Berlin, in 1747; and so recommended himself both by his ability as a teacher and by his attainments, that in 1750 he was admitted into the Academy of Sciences. The same year was that of his marriage with an amiable woman, whom he had the misfortune to lose in 1760; in consequence of which bereavement he quitted Berlin, and made a visit to his native country, where he recovered his wonted health and spirits, and where he first conceived the plan of his great work, the 'Theory of the Fine Arts.' He would have gladly remained in Switzerland, and he made application to that effect, but instead of listening to it, the king made him a professor at the newly established *Ritter-Academie*, or military college, with a very considerable pension, and also bestowed on him a piece of ground in the immediate environs of Berlin, where he afterwards built himself a villa and laid out a botanical garden. He accordingly returned to Prussia in 1763, where he remained till 1775, when he was advised to travel for the benefit of his health, then greatly impaired. He visited the south of France, Switzerland, and Lombardy, of which tour he kept a journal that was published shortly after his death. On his return to Berlin, his health, which had been considerably improved, again declined. He died February 25th, 1779.

Great as was the distinction he acquired among his contemporaries in other and far different branches of knowledge, Sulzer's fame now rests chiefly upon his 'Allgemeine Theorie der Schönen Kunste,' a cyclopædia of literature and the fine arts; and, as Herder says of it, one that is in itself an entire academy. To the plan itself it may be objected that the alphabetical arrangement, though recommended by its convenience, is not the best; and that as a dictionary the work now stands in need of considerable additions and augmentations; nevertheless it is a very remarkable one, not so much on account of the mere literary industry it displays, as for its unity and consistency, and for the original and philosophical mind which pervades the whole, and which stamps it as a well-constructed system of æsthetics. Although this work was announced by its author in 1760, it did not appear till 1771-4, for Sulzer had not calculated upon the time it would take to render its execution satisfactory to himself as well as the public. The second edition, in four large volumes, 8vo., with a supplement containing additions and corrections, was published 1792-4; and in 1799 came out an appendix to it, forming a complete 'Index' of all the writers, artists, &c. referred to in it. There are also distinct works intended as accompaniments to the 'Allgemeine Theorie:' one by Blankenburg, entitled 'Literary Additions,' &c., 3 vols. 8vo, 1796-8; the other 'Nachträge' (supplementary articles), by Schatz and Dyck, 8 vols. 8vo., 1792-1808. Of Sulzer's other writings the principal are: 'Moral Reflections on the Works of Nature,' Berlin, 1741; and 'Philosophical Pieces,' 1773-86.

(Jörden's *Lexicon*; Wolff, *Ency. National-litteratur.*)

SUM AND DIFFERENCE. There is no need to define the arithmetical meaning of these terms: a few words only are necessary to put them in their proper position in algebra. When quantities receive their proper algebraical signs, and those signs their interpretations [SIGN; NEGATIVE, &c.], they are said to be added to a quantity when they are allowed to produce their effect, and subtracted when they are allowed to produce a contrary effect. And when quantities are put together so that each produces its simple effect, they are said to be added together; while any parcel which is either withdrawn, or compensated by others of equal and opposite effects, is said to be subtracted. We are not here discussing principles, but settling terms; and it is enough if the notions appended to them are proper foundations for clear and good deduction; and an additional advantage if common ideas and received phraseology are also suited, provided that nothing be assumed from such ideas and phraseology to the prejudice of the dependence of the deduction upon the prescribed definitions.

To form a just idea of the property of any person, we take the sums which he owes away from his assets; that is, we take away, not his debts, but sums out of his assets equal to his debts. To say that this is taking away his debts would not be correct; for taking away his debts would be merely destroying his liabilities, without making his assets answerable: a person who pays another's debts himself takes them away. A court of justice which decides a claim against the assets of any one, annexes or puts on a liability; and this is in algebra *adding*: if the decision should be reversed on appeal, this liability to pay is removed, and this is in algebra subtracting. In the phrase 'to gain a loss,' the word 'gain' is used in the preceding sense of simple adjunction: if it were as common to talk of losing a loss, the verb to lose would be used in the sense of to remove or to get rid of; the other form of the word would be less of a bull, for to *loose* a loss would be to detach it. In a third form, the idiom is still plainer; to *release* [from] a loss would be precisely the idea of algebra, answering to subtracting a loss. Such things we mention, because by some persons those ideas of algebraical operation to which common idioms adapt them-

selves are easily received, as if the understanding of these common idioms were the same as that of the algebraical proposition; while other operations which have no such common phrases to illustrate them are difficulties.

SUM (in the sense of Integral). Before the organization of the formal integral calculus, the isolated operations of integration which were attained were expressed in words borrowed apparently from the notion of indivisibles. [CAVALIERI.] Thus the title of one of Halley's papers is 'An Easy Demonstration of the Analogy of the Logarithmic Tangents to the Meridian Line or Sum of the Secants.' Here the sum of the secants means what we should now denote by $\int \sec x.dx$.

SUM, SUMMATION. In the articles INTEGRATION, FINITE, and PROGRESSION, some ideas and rules are given upon the subject of the summation of a finite number of terms of a series; and in SERIES will be found examples of the inverse process of development. In the present article we are to give some account of the methods of actual summation which are in use in the higher branches of mathematics; referring for the demonstrations to the Differential Calculus in the Library of Useful Knowledge (cited by the letters D. C.). We shall dwell upon this at greater length than would appear to be altogether in keeping with the extent of the articles above cited; the reason being that many persons to whom the following rules might be practically useful never hear of them because they are locked up in Treatises on the Differential Calculus, or in works which are not generally read. The merest elements of differentiation and integration are enough to enable a beginner to *use* results, the *proof* of which must be received for a more advanced stage of his progress.

1. When the terms of a series are alternately positive and negative, as in $a_0-a_1+a_2-$ &c., the sum of the series *ad infinitum* may thus be expressed [DIFFERENCE] (D. C., pp. 556 560):—

$$\frac{a_0}{2}-\frac{\Delta a_0}{4}+\frac{\Delta^2 a_0}{8}-\frac{\Delta^3 a_0}{16}+\ldots\ldots$$

which is frequently more convergent than the series itself: in fact, the less convergent the series is, the more convergent is the transformation. Dr. Hutton's method of obtaining the transformed series is as follows:—Take a number of the successive sums a_0, a_0-a_1, &c., and let

$$S_0=0\ ,\ S_1=a_0\ ,\ S_2=a_0-a_1\ ,\ S_3=a_0-a_1+a_2\ ,\ \&c.$$

Take the half sum of S_0 and S_1, the half sum of S_1 and S_2, the half sum of S_2 and S_3, &c. Let these be T_0, T_1, T_2, &c. Repeat the process: take the mean of T_0 and T_1, that of T_1 and T_2, &c., which call U_0, U_1, &c. Take the mean of U_0 and U_1, that of U_1 and U_2, &c., which call V_0, V_1, &c. Then the set S_0, T_0, U_0, V_0, &c. will severally approach nearer and nearer to the series required: in fact

$$T_0=\frac{a_0}{2}\ ,\ U_0=\frac{a_0}{2}-\frac{\Delta a_0}{4}\ ,\ V_0=\frac{a_0}{2}-\frac{\Delta a_0}{4}+\frac{\Delta^2 a_0}{8}\ ,\ \&c.$$

It would however be somewhat easier to proceed as follows:—having formed differences as far as may be thought necessary, say up to $\Delta^n a_0$, take half $\Delta^n a_0$ from $\Delta^{n-1} a_0$, half the result from $\Delta^{n-2} a_0$, half the result from $\Delta^{n-3} a_0$, and so on until a_0 has been used: after which halve the result again. In either case we need not begin at the beginning of the series: if it be more convenient to begin after a_{10} let $A_{10}=a_0-a_1+\ldots\ldots-a_9+a_{10}$, and calculate this separately: then calculate $a_{11}-a_{12}+\ldots$ from the rule, and we have A_{10} $(a_{11}-a_{12}+\ldots)$ for the series required. The following is an instance from Dr. Hutton (*Tracts*, vol. i., p. 191), the series being $1-\frac{1}{2}+\frac{1}{3}-\frac{1}{4}+\ldots\ldots$

Suc. Sums.	The several orders of means.					
1						
0·5						
833333						
583333						
783333						
616666						
759524	698095					
634524	697024	692560				
745635	690080	693652	693056			
645635	693615	692858	693205	693131		
736544	691070	693763	693110	693158	693144	693147
653211	694878	692984	693173	693142	693150	

The result is ·693147, which is correct to the sixth place, and is more than could be got from the series itself by actual summation of a million of its terms. Dr. Hutton begins in forming the means with $1-\frac{1}{2}+\ldots\ldots+\frac{1}{6}$: we shall therefore try the other method, beginning with $\frac{1}{7}$.

Suc. Terms.	Orders of differences				
	−	+	−	+	−
·142857	17857	3968	1190	432	179
·125000	13889	2778	758	253	
·111111	11111	2020	505		
·100000	9091	1515			
·090909	7576				
·083333					

2)−179
−89·5
432
2)342·5
[illegible]·8
−1190
2)−1[illegible]·8
−725·4
3968
2)[illegible]93·4
2346·7
−17857
2)−2[illegible]03·7
−10101·9
142857
2)132[illegible]58·9
76479·5

$$1-\tfrac{1}{2}+\ldots-\tfrac{1}{6}=\cdot 6166666$$
$$\cdot 0764795$$
$$\cdot 6931461$$

This last process will be found on trial the easier of the two.

2. The sum of the series $a_0-a_1+a_2-$ &c. *ad infinitum* may be thus expressed (D. C, p. 555):—

$$\frac{a_0}{2}-\frac{a'_0}{4}+\frac{a'''_0}{48}-\frac{\overset{\text{v}}{a}_0}{480}+\frac{17\overset{\text{vii}}{a}_0}{80640}-\&c.$$

where a_x, a function of x, generates the several terms by making $x=0, 1, 2$, &c. in succession, and a'_0, a'''_0, $\overset{\text{v}}{a}_0$, &c. mean the values of the odd differential coefficients of a_x, when x is $=0$. This transformation is useful when the values just mentioned are not considerable. Another form, which is sometimes more convenient, is—

$$\frac{a_0}{2}-\frac{a'_0}{4}+\frac{a'''_0}{2[4]}-\frac{3\overset{\text{v}}{a}_0}{2[6]}+\frac{17\overset{\text{vii}}{a}_0}{2[8]}-\&c.$$

where $[m]$ means $1.2.3\ldots\ldots m$. In the instance before us, and that we may begin from the same term as before, let

$$a_x=\frac{1}{7+x}\ ,\ a_0=\frac{1}{7}\ ,\ a_1=\frac{1}{8}\ ,\&c.$$

$$a_0=-\frac{1}{7^2}\ ,\ a'''_0=-\frac{[3]}{7^4}\ ,\ \overset{\text{v}}{a}_0=-\frac{[5]}{7^6},\overset{\text{vii}}{a}_0=-\frac{[7]}{7^8};$$

whence the series required from and after $\frac{1}{7}$ is—

$$\frac{1}{14}+\frac{1}{4.7^2}-\frac{1}{2.4.7^4}+\frac{3}{2.6.7^6}-\frac{17}{2.}$$

Call these terms (1), (2), &c., and begin with $\frac{1}{2}+\quad-\frac{1}{6}$, or ·616666....: we have then—

	·6166666667
(1)	·0714285714
	·6880952381
(2)	·0051020408
	·6931972789
(3) −	·0000520616
	·6931452173
(4)	·0000021250
	·6931473423
(5) −	·0000001843
	·6931471580
True Answer	·6931471806

The result of this comparatively easy process is as correct as the summation of fifty millions of terms of the series.

3. The sum of any large number of terms of a series may be found by summing the whole series *ad infinitum*, then doing the same with the terms following the last term which is to be retained, and subtracting the second result from the first.

4. The sums of such series as are included under $1^{-n}+2^{-n}+3^{-n}+$ &c., such as

$$1+\frac{1}{4}+\frac{1}{9}+\ldots\ ,\ 1+\frac{1}{8}+\frac{1}{27}+\&c.$$

continued *ad infinitum*, may be given for reference in the following table. The first term will presently be explained. More will be found in D. C., p. 554.

n.	Sum of Series.
1	·5772156649015329 + log ∞
2	1·6449340668482264
3	1·2020569031595943
4	1·0823232337111382
5	1·0369277551433700
6	1·0173430619844491
7	1·0083492773819227
8	1·0040773561979443
9	1·0020083928260822
10	1·0009945751278180
11	1·0004941886041194
12	1·0002460865533080

The first line means that the sum of the series is infinite, but that the expression for a large number of terms contains the logarithm of that number, which being removed, the rest of the expression approximates as the number of terms increases, to ·577215....

5. The series $\overline{1}^{n} - \overline{2}^{n} + \ldots$ is connected with $1^n + 2^n + \ldots$ by the following simple law:—

$$\overline{1}^{n} - \overline{2}^{n} + \overline{3}^{n} - \ldots = \left(1 - \frac{1}{2^{n-1}}\right)\left(\overline{1}^{n} + \overline{2}^{n} + \overline{3}^{n} + \ldots\right)$$

6. The sum $a_0 + a_1 + a_2 + \ldots$ *ad infinitum* may be thus transformed:—

$$\int_0^\infty a_x dx + \frac{1}{2}a_0 - \frac{1}{6}\frac{a'_0}{2} + \frac{1}{30}\frac{a'''_0}{[4]} - \frac{1}{42}\frac{a^{\text{v}}_0}{[6]} + \&\text{c.}$$

where the notation is as previously explained, and $\frac{1}{2}, \frac{1}{6}, \frac{1}{30}$, &c. are the series of NUMBERS OF BERNOULLI. To apply this, for example, to $1^{-2} + 2^{-2} + 3^{-2} + \ldots$, it will be convenient to begin from some term which will make the series more convergent. Let $a_x = (10 + x)^{-2}$: we have then for $10^{-2} + 11^{-2} + \ldots$ the following:—

$$\frac{1}{10} + \frac{1}{2}\frac{1}{10^2} + \frac{1}{6}\frac{1}{10^3} - \frac{1}{30}\frac{1}{10^5} + \frac{1}{42}\frac{1}{10^7} - \&\text{c.},$$

which may be easily calculated, and the preliminary series $1^{-2} + \ldots + 9^{-2}$ may then be added.

7. The finite series $a_0 + a_1 + a_2 + \ldots + a_{x-1}$ (x terms) is thus transformed (D. C., p. 266):—

$$\int_0^x a_x dx - \frac{1}{2}(a_x - a_0) + \frac{1}{6}\frac{a'_x - a'_0}{2}$$

$$-\frac{1}{30}\frac{a'''_x - a'''_0}{[4]} + \frac{1}{42}\frac{a^{\text{v}}_x - a^{\text{v}}_0}{[6]} - \frac{1}{30}\frac{a^{\text{vii}}_x - a^{\text{vii}}_0}{[8]} + \&\text{c.},$$

in which the detached coefficients are again the numbers of Bernoulli. Or, if the sum of the series *ad infinitum* be known, S, the preceding may be expressed as follows:—

$$S - \int_x^\infty a_x dx - \frac{1}{2}a_x + \frac{1}{6}\frac{a'_x}{2} - \frac{1}{30}\frac{a'''_x}{[4]} + \&\text{c.}$$

But when the complete series is divergent, the set of terms $a_0 + a_1 + \ldots + a_{x-1}$ may be thus expressed:—

$$C + \int_0^x a_x dx - \frac{1}{2}a_x + \frac{1}{6}\frac{a'_x}{2} - \frac{1}{30}\frac{a'''_x}{[4]} + \&\text{c.},$$

where C must be determined by an instance. Thus if we make $a_x = (1 + x)^{-1}$ we have for $1 + 2^{-1} + \ldots + x^{-1}$ the following series:—

$$C + \log^*(1 + x) - \frac{1}{2}\frac{1}{1+x} - \frac{1}{12}\frac{1}{(1+x)^2} + \frac{1}{120}\frac{1}{(1+x)^4} - \&\text{c.}$$

Add $(x + 1)^{-1}$ to both sides, and write $x - 1$ for x, which gives for $1^{-1} + \ldots + x^{-1} =$

$$C + \log x + \frac{1}{2x} - \frac{1}{12x^2} + \frac{1}{120x^4} - \&\text{c.}$$

* The Naperian logarithm, which is always used in mathematical investigations, unless the contrary be expressed. It is 2·302585093 × comm. log.

To determine C, choose such a number for x as shall make this series convergent, say $x = 10$. Calculate $1^{-1} + \ldots + 10^{-1}$, term by term, which is easily done, and equate the sum to

$$C + 2{\cdot}302585093 + \frac{1}{20} - \frac{1}{1200} + \frac{1}{1200000} - \&\text{c.},$$

which gives C=·5772156 ..., the number mentioned at the head of the table for series of inverse powers already given. With the value of C thus determined, and a sufficient table of logarithms, the larger the number of terms in $1^{-1} + \ldots + x^{-1}$, the more easily is its approximate value calculated.

8. The series $\log 1 + \log 2 + \ldots + \log x$ is of sufficient importance to have an article to itself. Make $a_x = \log(1+x)$, and proceed as in the last example, which will give for $\log(1.2.3\ldots x)$ the following series:—

$$C + \log x.\, x - x + \frac{1}{2}\log x + \frac{1}{12x} - \frac{1}{360x^3} + \ldots$$

C might be determined as before, but a particular mode of investigation shows it to be $\log(\sqrt{2\pi})$, where $\pi = 3{\cdot}14159\ldots$, as usual. This gives

$$1.2.3\ldots x = \sqrt{2\pi x}\, x^x.\ \epsilon^{-x + \frac{1}{12x} - \frac{1}{360x^3} + \&\text{c.}},$$

a result of the greatest use, particularly in the more complicated applications of the theory of probabilities.

9. The series $0^n + 1^n + 2^n + \ldots + x^n$, in which $a_x = x^n$, n being integer and positive, is by the case of § 7, and adding x^n to both sides,

$$C + \frac{x^{n+1}}{n+1} + \frac{x^n}{2} + \frac{1}{6}\frac{nx^{n-1}}{2} - \frac{1}{30}\frac{n(n-1)(n-2)x^{n-3}}{2.3.4} + $$

&c.; but this vanishes when $x=0$, whence C must be taken accordingly in every instance. To take an example which shall require a little extension of the series beyond the terms used above, let it be required to find $0^7 + 1^7 + \ldots + x^7$. Looking at the article NUMBERS OF BERNOULLI, we find a supply of coefficients in

$$\frac{1}{6}\ \frac{1}{30}\ \frac{1}{42}\ \frac{1}{30}\ \frac{5}{66}\ \frac{691}{2730},$$

and the sum required is

$$C + \frac{x^8}{8} + \frac{x^7}{2} + \frac{1}{6}\frac{7x^6}{2} - \frac{1}{30}\frac{7.6.5\,x^4}{2.3.4} + \frac{1}{42}\frac{7.6.5.4.3\,x^2}{2.3.4.5.6}$$

$$-\frac{1}{30}\frac{7.6.5.4.3.2.1}{2.3.4.5.6.7.8},$$

which vanishes when $x=0$, whence

$$C + \frac{1}{30}\frac{7.6.5.4.3.2.1}{2.3.4.5.6.7.8} = 0,$$

and the rest may be reduced to

$$\frac{x^8}{8} + \frac{x^7}{2} + \frac{7x^6}{12} - \frac{7x^4}{24} + \frac{x^2}{12},$$

or $\quad (3x^8 + 12x^7 + 14x^6 - 7x^4 + 2x^2) \div 24.$

SUMACH. [RHUS.]

SUMAROKOV, ALEXANDER PETROVITCH, whose name was, after that of his contemporary and literary rival Lomonosov, almost the only one that, until of late years, was at all known in this country as that of a Russian poet, was born at St. Petersburg in 1718, and was the son of a general officer. He was educated first at home, and afterwards in the Land Cadet Corps, where he soon distinguished himself by his ability. The study of Corneille and Racine inspired him with a taste for dramatic composition; and at about the age of twenty-five he began to attempt it. His tragedies were at first performed at court before the empress Elizabeth, for there was then no public theatre, and as they satisfied the principal person, they were loudly applauded by the rest of the audience. This success encouraged Sumarokov, who was naturally of a vain disposition, and he determined to establish a permanent theatre in the capital; an attempt in which he was greatly aided by the influence of his father (Peter Pankratievitch), who, besides being a person of some consequence in other respects, held a post near the person of the grand-duke Peter. The result was, that the theatre was opened in 1756, under the immediate patronage of the court, and

Sumarokov appointed its director; whence he has been generally considered the founder both of the Russian theatre and the Russian drama. But dramatic entertainments were not totally unknown to his countrymen before his time, for they had been introduced at court at the close of the preceding century, and the scriptural pieces of Demetrius, bishop of Rostov, had been performed (b. 1651, d. 1709). At the very time too that Sumarokov was organising his plans, there was not only a small theatre at Yaroslav, but it was thence that he obtained his chief performers, including the celebrated Volkov [VOLKOV] and Dmitrevsky, who afterwards obtained the appellation of the Russian Garrick.

Still, if not literally the originator, Sumarokov may be regarded as the founder of the drama in Russia: he brought it at once to comparative perfection; and frequently approached and perhaps would have surpassed his models, if he had not allowed himself to be trammelled by them, and if he had not, while aiming at the merits, adopted all the defects, the conventionalities, and rigorous poetical etiquette of the French stage and its rhymed Alexandrine versification. Among his tragedies, his 'Semira,' and 'Sinov and Truvor,' are his best and most original productions, notwithstanding they are not, like his 'Demetrius,' on the list of acting pieces. As a comic writer, he hardly deserves mention, for his dramas of that class are little more than farces, occasionally coarse in expression, but less gross and less immoral than many comedies that, being less indelicate, are tolerated as decent. They have one merit, that of setting the example of prose dialogue as the most suitable for the drama of ordinary life: but their language is now become quite antiquated: a disadvantage more sensibly felt in Sumarokov's prose than in his poetry. There are indeed many exceedingly beautiful passages in his tragedies; so poetical in sentiment, and so felicitously turned, that they hardly suffer at all by comparison with any specimens of Russian poetry at the present day. Sumarokov attempted not only every species of the drama, including operas, but almost every form of poetical composition. He versified the 'Psalms' in ten books, and wrote a vast number of odes, satires, epistles, fables, eclogues, elegies, sonnets, epigrams, songs, and other pieces, besides several in prose, including some historical and didactic ones, and his 'Dialogues of the Dead,' &c. The first complete edition of his works was published in ten volumes, 8vo., in 1787, ten years after his death, which happened at Moscow, October 1, 1777. If no longer read, Sumarokov is certainly not forgotten, for he is one of those who have earned for themselves a traditional fame in literature that very long survives their works.

(Gretch, *Opuit Istorii, &c.: Otetchest. Zapiski.*)

SUMA'TRA is a large island in the Indian Ocean, and the most western of the Sunda Islands. The equator traverses the island nearly in the middle. Sumatra extends full six degrees to the south of that line, and nearly as much to the north. The most western point, Acheen Head, is in 95° 20′ E. long., and the most eastern part, the coast between Lucepara Point and the First Point at the southern entrance of Banca Strait, is in 108° E. long. The general direction of the island is nearly north-west and south-east, and its length rather exceeds 900 miles. The width south of 1° N. lat. is on an average 210 miles, but farther north not more than 140 miles. According to a rough estimate, its area is rather more than 160,000 square miles, exceeding by more than 40,000 square miles, or one-third of their surface, the extent of the British Islands.

The south-west side of Sumatra is bounded by the Indian Ocean; the northern part stretches into the Bay of Bengal; to the north-east it is divided from the Malay Peninsula by the Straits of Malacca. Between the southern extremity of these straits and the Island of Banca, it is washed by the Chinese Sea. It is divided from Banca by the Strait of Banca. The coast south of that strait is washed by the Java Sea, and its southern extremity is separated from Java by the Straits of Sunda.

Coast.—Sumatra terminates at the southern extremity on the Straits of Sunda in three promontories, including the bays of Lampong and Samangka; the latter is also called Keyser's Bay. The capes are called, from east to west, Tanjong Toca, or Hog's Point, Tanjong Kamantara, and Tanjong China. The two first-named capes are formed by rocks of moderate elevation, but the last is the eastern extremity of a low and woody tract which extends about seven miles westward to Flat Point, which is likewise low. The two bays lying between these capes, and containing several good and safe anchorages, are generally surrounded by a low tract, which however rises rapidly at a short distance from the sea, and soon attains the elevation of mountains.

The south-western coast from Flat Point to Manna, a distance rather exceeding 150 miles, rises with a steep ascent and generally to a considerable elevation. There are several indentations along it, but they are not deep, and are open to the surf so as to be unfit for vessels, with the exception of Croi and Cawoor, which are rather small. Along this part of the coast soundings are only found at a short distance from the shore. From Manna to Bencoolen, which are about 60 miles distant from each other, the coast continues to be high, and the cliffs descend with a gentle slope, so as to leave a narrow beach, which near Manna is more than half a mile wide for ten miles. There are several tolerably good harbours, as at Manna and Poolo Bay. The coast is clear of rocks, and there are only a few shoals. The soundings are regular, and extend from 20 to 25 miles from the coast. From Bencoolen to Tapanooly Bay, a distance of about 450 miles, the coast-line is alternately low and high, but the cliffs are of moderate elevation, and not often steep. This part of the coast, especially from Indrapura to Tapanooly, is lined with a considerable number of islands, most of them rather high, and in many places shoals of some extent occur. Though these islands and shoals render the navigation difficult, they protect the shipping against the tremendous surf to which the south-west coast of Sumatra is exposed, and make numerous good anchorages. Soundings are found almost everywhere, but in some places they are irregular. Though rather numerous, the headlands do not project far into the sea: good anchorage is found in their vicinity, and between them are several good harbours. Tapanooly is so large and spacious, and possesses so many advantages, that it is considered as hardly surpassed by any harbour on the globe: many small islands are dispersed over it, and subdivide it into numerous smaller harbours or coves, where ships are sheltered from all winds. It is said that all the navies in the world might ride here with perfect security in all weather. The coast continues to be lined with small rocky islands as far as Passage Island (2° 22′ N. lat.), north-west of the mouth of Singhel river. But north of Tapanooly Bay the coast-line is low and generally with a sandy beach, and thus it continues to the vicinity of Acheen Head, a distance of more than 300 miles. There occur several good harbours, sheltered from all winds; and as the surf in these parts is less violent, they supply good anchorage. The soundings are regular. Along these coasts there are also some small rocky islands, but they are less numerous than south of Passage Island.

Between 3° N. lat. and 3° S. lat., a chain of larger islands stretches parallel to the coast from north-west to south-east, at the distance of 60 or 70 miles. The sea between this chain of islands and Sumatra has soundings, but outside of the islands no soundings have been obtained. Between some of these islands there are safe channels. No coast perhaps is exposed to a more tremendous surf than the south-west coast of Sumatra, especially that portion of it which is south of the equator. This surf is very remarkable on account of its irregularities, for which no sufficient reason has been discovered. It seldom preserves the same degree of violence for two days together; often it rises like mountains in the morning and nearly subsides by night. It does not seem to be influenced by the winds, though it is much stronger during the south-eastern than during the north-western monsoon. Generally no landing can be effected in European boats, but only in catamarans. The spring-tides along this coast are estimated to rise four feet; the smallness of this rise is attributed to the open and unconfined situation of the coast, which prevents any accumulation of the tide, as is the case in narrow seas.

The north coast of Sumatra, between Acheen Head and Diamond Point, is called the coast of Pedir, and extends about 150 miles. The whole of this coast is high, and mostly steep, especially in the middle near Possangan Point. The sea is clear of rocks and shoals, and deep. At the distance of from 12 to 15 miles there are no soundings, and anchorage is seldom found farther than 6 miles from the beach. Most of the harbours are open roadsteads, but otherwise the anchorage is good.

The north-eastern coast of Sumatra, from Diamond Point to the mouth of the Rakan River, a distance of about

300 miles, is low, but well defined. North of Delli it is lined with sand-banks, and south of that place with mud-banks, which are traversed by a narrow channel, through which the rivers reach the sea. Along this coast the spring-tides rise from 8 to 10 feet. To the east of the mouth of Rakan River lies a headland, called Oujong Perbabean, to the north-west of which a mud bank extends about 11 or 12 miles. In this part the navigation of the Malacca Strait is very dangerous, as various sand-banks extend across it, with gaps and narrow channels of mud-soundings between them. Farther south is the Island (Pulo) of Rupat, extending about 25 miles in every direction. The Salat Rupat, or strait, which divides this island from the main body of Sumatra, admits only small vessels.

Between 1° 36′ and 35′ N. lat. there are three large islands, called Bucalisse, Padang, and Rankan, which are divided from Sumatra by Brewer's Strait, or Salat Panjang. This strait is from 1 to 5 miles wide, but navigable for large vessels. The strait dividing Bucalisse from Padang is called Salat Padang, and that which runs between Padang and Rankan is Salat Ringit: both of these can only be used by boats. The coast-line of these islands and that of Sumatra in these parts is low and generally swampy. In Brewer's Strait the spring-tides rise 15 feet.

South of the southern extremity of Brewer's Strait, as far as the Strait of Banca, and along the western shores of this strait to Cape Lucepara, the coast-line of Sumatra is exceedingly low. A great part of it is inundated at high-water, and it is surrounded by shoal mud-banks, which extend in some places from 2 to 3 miles from the shore. From Lucepara Point to the eastern entrance of the Strait of Sunda, the coast-line is likewise low, but well defined: it is lined with shoals and mud-banks, which run out from 7 to 10 miles from the shore in some places.

Physical Regions, Surface, Soil, Climate, and Productions.—The north-eastern side of Sumatra is a low and level plain; the south-western is either mountainous or hilly. On looking at our maps, one would suppose that each of these two regions occupies one-half of the island; and so it may be: but it must be borne in mind that no European traveller has advanced from the north-east shores far enough inland to reach the base of the mountains; nor has any one, after departing from the south-western coast and traversing the mountains, descended into the plain, with the exception of an officer under the administration of Raffles, who went from Bencoolen to Palembang; but as no account of his journey has been published, the line which divides the two great regions is not known, except where it borders on the sea.

The *Mountain Region* begins on the shores of the Straits of Sunda, with the elevated promontories of Tanjong Toca and Tanjong Kamantara. At a short distance from the first-named cape, and near the eastern shores of Lampong Bay, is the Raja Bassa Peak, which is about 1600 feet high. This mountain-summit is connected with the extensive mountain-masses which separate Lampong Bay from Samangka Bay, and on which the Keyzer's Peak probably rises to 5000 feet. Another range of mountains, which rises at the back of the flat tract between Tanjong China and Flat Point, runs north-west, and joins the great mass north of the innermost recess of Samangka Bay. The mountain-region thus formed seems to occupy between 6° and 4° 30′ S. lat. a tract exceeding 40 miles in width, if we include the lower ridges, which come close to the shores of the Indian Ocean. In this part of the mountain-region the watershed of the rivers, which flow eastward and westward, is at no great distance from the shores; and the rivers which descend from it to the Indian Ocean are only torrents, rushing down with incredible velocity during the rainy reasons, and destitute of water the remainder of the year. The country along the sea is a succession of high hills and narrow valleys, very little cultivated, and very thinly inhabited. It produces however much pepper. The ridge which forms the watershed does not appear to rise to a great elevation. East of this range a much more elevated chain of mountains occurs at about 20 miles from the shores of the Indian Ocean. It is however much more broken, as all the waters collected in the intermediate space break through it, and find their way to the eastern plain. Some of the summits are visible from the sea. Several ridges which detach themselves from these masses run eastward, and extend to a considerable distance into the eastern plains. The space enclosed by the two parallel ridges is an elevated table-land, the surface of which is very broken and hilly; and it contains several large lakes, as those of Ranan and of Lukitan. The level undulating country which surrounds these lakes is of great fertility, well cultivated, and comparatively well settled. It produces pepper, cotton, indigo, tobacco, sugar-cane, maize, rice, sweet potatoes, and several other roots; and also plantains and pine-apples. Gold is said to exist in this region. The numerous rivers which flow eastward constitute the principal branches of the two large rivers Tulan Booang and Palembang.

The central mountain-region may be considered as extending from 4° 30′ S lat. to Tappanooly Bay, or 1° 40′ N. lat. It contains the highest ranges in the whole system, and occupies a much larger tract in width than the other portions of the mountain-region; but the mountains do not advance close to the shores of the Indian Ocean, being divided from it by a comparatively low tract, generally 20 miles in breadth, in some places less, and in others widening to 30 miles. This lower tract we are better acquainted with than any other portion of Sumatra, as several European settlements have existed here for two centuries. The surface of this tract, as Marsden says, is intersected and rendered 'uneven to a surprising degree by swamps, whose irregular and winding course may in some places be traced in a continual chain for many miles, till they discharge themselves either into the sea, some neighbouring lake, or the fens that are commonly found near the banks of the larger rivers, and receive their overflowings in the rainy monsoon. The spots of land which these swamps encompass become so many islands and peninsulas, sometimes flat at top, and often mere ridges, having in some places a gentle declivity, and in others descending almost perpendicularly to the depth of a hundred feet. In few parts of the country of Bencoolen, or of the northern districts adjacent to it, could a tolerably level space of 400 yards square be marked out. The hollows and swellings are for the most part smooth and regularly sloping, so as to exhibit not unfrequently the appearance of an amphitheatre; and they are clothed with verdure from the summit to the edge of the swamp. Many of the swamps have no apparent outlet.' Marden attributes this surprising irregularity of surface to the springs of water with which these parts of the island abound. The general level of the country rises very gradually to the base of the mountains, where the ascent is very abrupt and rather steep. The soil consists of a fine red vegetable clay, covered with a layer of black mould of no considerable depth. Few stones are found in it. The whole region, except the small isolated spots which are cultivated, is either covered with rank grass, brushwood, or timber-trees, according as the country has remained uncultivated a longer or shorter time. To the south of Bencoolen it is almost an impervious forest. No country is better supplied with water than this part of Sumatra. Springs are abundant, and the rivers are very numerous. Though the course of none of the rivers perhaps exceeds 50 miles, and their upper part is full of shoals and cataracts, they are usually navigable for small craft from the point where they enter this low tract to their mouth. But all these rivers have a bar across their embouchure, the effect of the surf which breaks along this coast-line.

There are only two seasons, the dry and wet, and they are regulated by the monsoons. In most parts of India to the north of the equator the north-east monsoon prevails when the sun is in the southern hemisphere, and the south-western when the sun is in the northern hemisphere [MONSOON]; but on this coast of Sumatra the monsoons are changed by the direction of the land, the north-eastern into a north-western, and the south-western into a south-eastern monsoon. The south-eastern monsoon begins about May and leaves off in September; the north-western monsoon begins in November and blows to the end of March. These winds for the most part commence and leave off gradually; and in the intervening months, April and May, October and November, the weather and winds are variable and uncertain. The south-eastern monsoon blows with great force and steadiness from the end of June to late in September; and during this period rain seldom falls, except in showers, and generally in the night. When the north-west monsoon is strongest, from November to January, the rain is abundant, though in a much less degree than on the coast of Coromandel. The rains do not sensibly abate until March. The quantity of rain which falls annually has not been determined. Thunder and lightning are very frequent. In the south-east monsoon the lightning is more constant; but the

coruscations are less vivid, and the thunder is scarcely audible. The atmosphere is generally more cloudy than in Europe, which is perceived from the unfrequency of clear star-light nights. The fog, which is observed to rise every morning among the distant hills, is dense to a surprising degree, and it seldom disperses till about three hours after sunrise. When the monsoons are in full strength, they commonly pass over the country; but when they abate, and during the intervals, sea and land breezes prevail. The sea-breeze sets in between nine and ten o'clock in the morning, subsequent to a calm, and declines with the setting sun; the land-breeze begins early in the night, and continues till eight or nine o'clock in the morning. The sea-breezes are regular and steady; but the land-breeze is subject to many irregularities, especially during the north-west monsoon. The land-breezes are rather cool, a circumstance which influences the temperature of the night. The heat in the day-time is considerable, but rather less than might be expected near the equator. At Bencoolen the thermometer never rises above 86°, and even at Natal not above 88°: at sun rise it is usually as low as 70°, on account of the cool land-breeze which descends from the mountains, covered with clouds, and bathed in constant vapours or rain. The mean annual temperature is probably between 82° and 83°. As this region is traversed by the equator, the temperature is nearly equal all the year round.

Although the country is thinly inhabited and ill cultivated, except near the European settlements and a few ports which are visited by traders, it produces several articles of export, as pepper, camphor-barus, gold-dust, ivory, and benzoin; but only the first and the last are obtained within this lower tract; the others are brought from the country at the back of it. The soil is indeed not distinguished by fertility, but when cultivated it produces rice, maize, tobacco, cotton, indigo, sugar, coffee, and the most exquisite fruits of the Indian Archipelago, as the mangusteen, durian, jack-fruit, plantains, oranges, and others, with several roots which are used as food.

The mountain-region which lies at the back of this low tract has only been partially explored by Europeans. It appears to be traversed by three, and in some parts by more than three, ranges, running parallel to the coast in the direction of the island from south-east to north-west. The two most western ranges run at a short distance from one another, and the most eastern of them constitutes the watershed of the rivers which flow east and west. The country east of this last-mentioned range, which occupies the greater part of the mountain-region, is partly occupied by mountain-masses, enclosing wide valleys, and partly extends in plains of a hilly surface. This region contains several volcanoes, which may be considered as the connecting link between the chain of volcanoes which traverse Java and the Lesser Sunda Islands [SUNDA ISLANDS], and those which extend northward through the Bay of Bengal, over Barren Island and Narcondom, to the coast of Aracan, and of which traces have been found as far north as the Tipperah Mountains. [SILHET.] The most southern of the volcanoes in Sumatra, Gunong Dempo, which is known, is near 3° 40′ S. lat. Its three peaks rise to about 12,000 feet above the sea, and are always enveloped in smoke. A volcano of moderate elevation occurs about 30 miles east of Bencoolen, which made an eruption about a century ago, and emitted smoke for a long time. Near 1° 30′ S. lat. is the volcano of Gunong Api, or Berapi, which rises to a great elevation. In the elevated mountain-masses which enclose the table-land of Menangcabau on the north are the volcanoes of Berapi, 13,195 feet above the sea, and the Gunong Sinkalang, which is 12,468 feet high. They lie near 9′ S. lat., east and west of one another. Mount Ophir, or Gunong Pasaman, which is near 5′ N. lat., and 13,850 feet above the sea, has also the form of a volcano, but is not active. The most northern of the volcanoes of Sumatra is the Batagapit, which is near 3° 42′ N. lat., in the eastern range of the mountains.

Several parts of this region have been visited, as the wide valley of the river Musi, between 3° and 4° S. lat., the country of Sungei Tenang, between 2° and 3° N. lat., and the country of the Korinchi, north of 2°; and it was found that the western mountain-ranges and their declivities and valleys were nearly uninhabited, but that the valleys and plains of the central portion of the mountain-region exhibited a considerable degree of agricultural industry, and were rather well peopled. Pepper plantations are frequent and extensive; maize is grown to a great extent, and also sweet potatoes and tobacco. Near the lakes, as near that of Korinchi, or St. George's Lake, there are rice-fields. Indigo, cotton, and sugar-cane are also cultivated. The mountains which separate these cultivated tracts from the Indian Ocean attain a great elevation, as appears from the thermometer descending here in the night-time to 40°. The most remarkable of these countries enclosed within the mountain-region is that of Menangcabau, which extends from 1° S. lat. to near the equator. It is a plain, extending about 50 miles in every direction, and surrounded by high mountains. The ranges which lie west of it, and separate it from the lower tract along the Indian Ocean, are only from 5500 to 6500 feet high, but those which lie south of it are much higher: one of the summits, the Buckit Talang, is 10,032 feet above the sea-level. The range which lies east of the plain contains no lofty summits. But on the north-east stands the mountain-mass of the Kasumba, the highest mountain in Sumatra, which rises to about 15,000 feet above the sea-level, and west of it are the volcanoes of Berapi and Sinkalang. The surface of the plain is rather hilly and broken than undulating, and the lowest part of it is occupied by the lake of Sincara, which is 1035 feet above the sea-level. The whole country is one continued scene of cultivation, interspersed with numerous towns and villages shaded by the cocoa-nut and fruit trees. It is not inferior to the best-cultivated parts of the Island of Java; and Sir Thomas Raffles thinks that the population cannot be less than a million. Every kind of grain, fruit, or root cultivated in any part of Sumatra is grown here in abundance, and the people apply themselves also to manufactures. The waters which descend from the neighbouring mountains to the lake of Sincara are carried off by a river called Ambilang, the most remote source of the river Indragiri, which falls into the China Sea between 0° and 30′ S. lat. It is thought that it might be used as a channel of conveyance from the place where it issues from the lake to its mouth.

The plain of Menangcabau, not being greatly elevated above the level of the sea, does not materially differ in climate from the lower country along the shores of the Indian Ocean; but other parts are more elevated, and beyond the most western ridge the temperature is much lower, so that the inhabitants light fires in the morning and continue them till the day is advanced. To this cold the backwardness in the growth of the cocoa-nut is attributed, which is sometimes 20 or 30 years in coming to perfection, and often fails to produce fruit.

The northern part of the mountain-region, or that which extends from 1° to the most northern extremity of the island, contains a low plain, which lies along the Indian Ocean, and may be about 10 or 12 miles in width, and rather a hilly tract, which lies at the back of the plain, and is about 25 miles across. The plain is generally low and level. Along the coast it is chiefly covered with jungle, but further inland with high forest-trees. The greater part of it is uncultivated, and very thinly inhabited. Between the plain and the mountain is a tract of very broken surface, full of steep rocks and covered with woods, but uninhabited. The mountain-tract is traversed in the direction of the island by three or four ridges, which occupy only a small width and are separated by extensive plains. None of the mountains are visible to a great distance from the sea. The central ridge seems to rise to the greatest height, and at its most northern extremity, south-east of the town of Acheen, is the Queen's Mountain, whose summit is at least 6900 feet above the sea-level. The most southern ridge terminates in Acheen Head, a bluff but not very lofty promontory. The ridges themselves are overgrown with forests, in which the camphor-tree is frequently met with south of 3° S. lat., and also the cassia-tree, and the tree from which benzoin is obtained. The plains in some places are level, and in others full of small hills, but the whole country is cleared, and either planted with rice and maize, or used as pasture-grounds for buffaloes, cattle, and horses. Pepper plantations are very numerous in these plains, and they occur also frequently in the low tracts along the sea. The watershed in this region is generally formed by the eastern ridge of mountains, and consequently the rivers which drain the plains and longitudinal valleys have a longer course and are less rapid than farther south, and are used for inland navigation. One of the plains between the mountains is occupied by a large lake, the Laut Ayer Tawar lake, which, according to the information obtained from the natives, is of great extent, but it has never been seen by a European. The coun

try about the lake is said to be in a high state of cultivation. The climate of this region differs in one respect materially from that south of the equator. The dry season does not take place during the south-eastern, but during the north-western monsoon, as is the case on the coast of Malabar, but showers occur frequently during the dry season.

The hilly tract which extends along the north coast of Sumatra, from the valley of Acheen and Queen's Mountain on the west to Diamond Point on the east, a distance of about 130 miles, may be considered as an appendage of the mountain-region. From the high coast which bounds the sea the country rises gradually to the south with an undulating, and, in some parts, hilly surface, until it attains an elevation of about 1000 feet above the sea. The highest part of this tract lies at the back of Pasangam Point, where, at the distance of 10 miles, an abrupt conical peak, called Elephant Mountain, rises to a considerable elevation. West of Pasangam Point the country is less elevated, and Diamond Point is quite low, but the tract behind it is a table-land of moderate elevation. The climate of this country rather resembles that of Hindustan than that of the western coast. The monsoon blows from south-west from May to October, and during its strength, from May to September, the weather is very cloudy and much rain falls, but only in showers. At the change of the monsoon, in October and November, westerly winds prevail and little rain falls. The dry season takes place during the north-east monsoon, which regularly sets in towards the end of November, and blows steady to March. Towards the end of March the north-eastern winds are light and very variable, and so they continue in April. As the rains are not continual, and moderately abundant, and the soil is light and mixed with sand, it quickly absorbs the moisture. Consequently no rivers are formed by the rains, and as the slope of the eminences is very gentle and regular, no swamps are produced, which renders the climate of this tract more healthy than that of the other parts of Sumatra. The soil is tolerably fertile, and produces abundance of rice, much of which is exported, cotton and the finest tropical fruits, such as the mangusteen, mango, and jack, with several esculent vegetables. Cattle, horses, and goats are numerous. The principal commercial productions are betel-nuts and pepper. The country is well cultivated and rather populous.

The *Great Plain*, which extends over the eastern and probably greater part of Sumatra, from Diamond Point to Tanjong Toca, presents only some variety along the coast, but as far as the interior is known it has a nearly uniform character. The northern part of it, as far south as the mouth of the Rahan river, though low, is sufficiently elevated above the level of the sea to be out of the reach of its inundations at spring-tides. The surface is level, or rather slightly undulating. The rivers which traverse this tract have not a long course, but several of them form tolerable harbours at their mouths, though they are rather difficult of access on account of the sand or mud banks between which their entrances generally lie. The country is rather fertile, and its northern districts are tolerably peopled and cultivated. It produces a large quantity of pepper, gambier, tobacco, and rice, with several fruits and vegetables, but is deficient in domestic animals.

The central portion of the plain, extending from Rahan river to Lucepara Point, is extremely low along the sea-coast, and a large portion of it is covered with water at spring-tides, and thus converted into a large swamp. This swamp is thickly wooded, and resembles in every respect the Sunderbunds in Bengal. It is uncultivated, and nearly uninhabited, except by some straggling families on the banks of the rivers. This low inundated tract extends from 10 to 30 miles inland. At the back of it the country rises with a moderate elevation and stretches out into a level plain to the base of the mountain-region. It is traversed by several large rivers, which on entering the low part of the country expand to a great width. They are navigable to the places where they leave the mountain-region, and in some cases even before they issue from its valleys. The more elevated portion of the country resembles in soil, fertility, and productions the country north of Rahan river. The cultivation of coffee was introduced some thirty years ago, and coffee now constitutes one of the most important articles of export. The country is tolerably well peopled.

The southern part of the plain, or that which fronts the Java Sea between Lucepara Point and Tanjong Toca, is less known than any other part of Sumatra near the sea. Though low, it seems to be sufficiently elevated to be beyond the reach of the inundations at high tides. Towards the interior the land rises, but the rivers, and among them the large river Tulan Booang, run through a wide depression, which during the rainy season is entirely covered with water by the inundation of the rivers. The productions of this tract have not been noticed.

The distinction of dry and wet seasons can hardly be applied to this plain. Neither the north-east nor the south-west monsoon is felt in all its force. The south-west monsoon is repelled from it by the mountain-region, which shelters the plain in that direction, and the influence of the north-east monsoon is broken by the range of high lands which traverse the Malay peninsula from north-north-west to south-south-east. The prevailing winds from March to September are the land and sea breezes, which are usually steady in the night, but faint and frequently interrupted by long calms in the day. Sometimes light winds varying between south-east and south-west are experienced, which may be considered as the effect of the south-west monsoon. In this season the Sumatras, as they are called, blow, especially in the first part of the night. They are sudden squalls, sometimes extremely severe. They come from the west, and are accompanied with tremendous thunder and lightning and heavy rain. The north-westers, which are less frequent, are likewise severe at the beginning, but they soon abate. The greatest quantity of rain falls in this season. The north-east monsoon is somewhat more regular, only interrupted by the land and sea breezes. Calms are less frequent than in the south-west monsoon, and the breezes are steady. The weather is much more settled, and thunder and rain less frequent, but still sufficiently abundant to render artificial irrigation unnecessary for agricultural purposes. The heat in summer is great, and at that period the air is saturated with moisture. In the dry season, on the other hand, it is moderated by the steady breezes. Though no meteorological observations have been made on this part of Sumatra, it is well known that the range of the thermometer is comparatively small, and it is supposed that it hardly exceeds 15° in the whole year. The climate is considered unhealthy for Europeans, especially along the southern low and swampy coast.

The islands which lie near the north-eastern coast of Sumatra, within the Strait of Malacca, are uniformly low, and their soil appears to be chiefly composed of alluvium. But the south-western coast of the island, between 3° N. lat. and 3° S. lat., is fronted by a chain of islands distant from it a little more than a degree. As they are of a different description, they require a short notice.

The most northern is called by our navigators Hog Island, by the Malays Pulo Babi, and by the natives Si Malu. It extends nearly north-west by west and south-east by east about 50 miles, and is about 10 or 12 miles broad, high, hilly, and covered with trees. The highest land probably does not exceed 1500 feet above the sea-level. Buffaloes and hogs are met with here in great plenty. No safe anchorage is known, and the island is seldom visited.

Pulo Nias, the largest island of this chain, extends nearly in a south-east direction about 70 miles, with an average width somewhat exceeding 18 miles. Many small islands line its shores, and the coast is generally steep. The land is usually high, well clothed with trees, and partly cultivated by the natives with rice. The inhabitants are very numerous, which may be inferred from the circumstance that formerly 1500 of them were annually sold as slaves, most of whom were sent to Batavia, where the females were held in high esteem on account of their great docility and talents. When the English were in possession of the western coasts of Sumatra, this traffic was put down, and it is not stated that it has been revived by the Dutch. Pulo Nias produces rice, yams, and beans for exportation, also poultry, buffaloes, cattle, and goats in abundance. It has several good harbours, as Seirombo on the western, and Tello Dalam, at the southern extremity.

Pulo Batu, commonly called Pulo Mintao, extends north and south about 48 miles, and is about 16 miles wide. It is situated immediately south of the equator. The land is moderately elevated, hilly, and the shores on both sides lined by many small islands, with a moderate depth of water around them, so as to form safe bays or harbours, which however are little known to Europeans. Only the northern part of the island is inhabited. It produces sago, cocoa-nuts, hogs, poultry, and trepang. Dammar, cocoa-nuts, cocoa-nut oil, and trepang are exported to Padang.

Si Beeroo, or North Porah, called Great Fortune by the Dutch, extends nearly north-west and south-east about 80 miles, with an average breadth of 12 miles. It is generally high land, covered with wood, higher in the middle than towards the extremities. Marsden says that this island contains a volcano. We find nothing noticed respecting its productions. Between this island and South Porah is Sea-flower's Channel, which is more than eight miles wide, free from danger, and at present much used by vessels bound to Padang and Bencoolen.

Si Porah, or South Porah, extends from north-west in a direction nearly south-east, about 36 miles in length, and is nearly 18 miles wide at the northern part, but decreases gradually to the southern extremity. There are three good harbours on the east side, Hurlock's Bay, Si Ooban Bay, and Si Labbah Bay. It is also hilly, but less elevated than Si Beeroo. The highest land is near Si Labbah Bay. The western side is very rocky, and the sea breaks high upon the shore: it is destitute of inhabitants. The eastern side is thinly inhabited, and produces sago, yams, and cocoa-nuts, with hogs and poultry.

Between this island and North Poggy is Nassau Strait, which is about 10 miles wide, and very safe. Then follow North and South Poggy islands. [Nassau Islands, vol. xvi., p. 93.]

At a great distance to the south is Engano Island, which has a triangular form, and is about 24 miles long and 18 broad in the widest part. It is moderately elevated, but when viewed from a distance has a level appearance. It is protected by a rocky shore. On the east side is an anchorage, but landing is very difficult. The inhabitants are much averse to any intercourse with foreigners. They speak a language quite different from that of the other islands and of Sumatra. They have neat canoes formed of two planks fastened together.

In the long and wide strait which separates the chain of islands just noticed from the main body of Sumatra, are the Baniah Islands or Pulo Bania (*i.e.* many islands), which consist of two principal islands a little separated, one lying to the eastward of the other, with several small ones contiguous to them. On the most northern island is a peak like a sugar-loaf, but otherwise this group is not much elevated above the sea, though rocky. These islands produce chiefly trepang and edible birds'-nests.

According to Marsden, these islands, with the exception of Engano, whose inhabitants seem to belong to another race, are occupied by two nations, both of which belong to the race of the Malays, but considerably differ in stature and language. The inhabitants of the islands north of 1° S. lat. are called Maruwis. Their complexions, especially in the women, are lighter than those of the Malays; they are smaller in their persons and shorter in stature; their mouths are broad, noses very flat, and their ears are extended in length in an extraordinary manner. They are, as already observed, remarkable for their docility and expertness in handicraft work, and soon become excellent carpenters and joiners. Their language has a radical affinity to that of the Battas in Sumatra, and they are Mohammedans. The nation inhabiting the islands south of 1° S. lat. are called Pagi, and are heathens: they are noticed under Nassau Islands [vol. xvi., p. 94].

Rivers.—The most important of the rivers which drain the south-west coast, which are navigated by small craft to some distance from their mouth, are from south to north as follow:—the Kataun (3° 20′ N. lat.), the Ipoo (3° 5′ S. lat.), the Indrapura (2° S. lat.), the Tabuyong (40′ N. lat.), the Batang Tara (1° 25′ N. lat.), and the Sinkel. The last-mentioned river is much the largest on this coast, and its course considerably exceeds 100 miles. It rises 30 miles from the sea, and flows through a wide valley nearly parallel to the shore for more than 70 miles to the south-east, when it bends to the south and enters the low country, where it is joined by the Sikeri about 20 miles from its mouth, which is near 2° 18′ N. lat. It is navigable for the greater part of its course for boats, and up to its confluence with the Sikeri the river is deep enough for vessels of considerable burden, but the bar at its mouth is dangerous, not having more than six feet of water at low-water, with a rise also of about six feet.

The rivers which rise in the mountain-region, and, traversing the eastern plain, fall into the Straits of Malacca and Banca, or into the China Sea, are larger and much better adapted for inland navigation. The most northern of them is the Delli river, which reaches the sea in 3° 46′ S. lat. Its mouth is a quarter of a mile wide, and has two fathoms depth at its bar at low-water, so as to admit vessels of moderate size. This depth continues for some distance from the sea, but the river then divides into several branches hardly deep enough for boats. The Battoo Barra river enters the sea in 3° 13′ N. lat., and forms a small harbour at its mouth only accessible for small vessels. The Assahan river, which falls into the sea near 3° N. lat., has a much longer course, and forms at its mouth a harbour for small vessels, which however is difficult of access on account of the mud-banks that surround it.

The Rakan river is rather a wide æstuary, which receives two considerable streams, than a river. The upper part of these two rivers, of which the southern and larger is called Sanahputeh river, is not known; but they must have a long course, for at their confluence, which is more than 30 miles from the sea, they are about a mile and a half wide. The river formed by their confluence is about two miles wide, and continues so for several miles, when it enlarges to four miles, and where it reaches the sea it is 15 miles wide. At its mouth there are two low and woody islands, between which is the entrance to the river. The navigation of this river is very dangerous, on account of the excessive rapidity of the tides, which run seven miles an hour, have a rise and fall of 30 feet, and produce a very high bore, by which the depth of the water is increased from four feet to two fathoms and a half in less than a minute. The river is almost dry at low-water of spring-tides.

The Siack river, which runs more than 200 miles, measured along its course, rises in the mountain-region, and probably on the northern declivity of Mount Kasumba or in its neighbourhood. It becomes navigable for boats before it issues from the mountains at Patapahan, and where it enters the plain the sloop navigation begins, which continues uninterrupted to its mouth. In this way the gold which is collected in the mountains of Menangcabau is brought to the Strait of Malacca. The river is comparatively narrow, for even at its mouth it is only three-quarters of a mile wide, but it is very deep. The entrance of the river also is narrow, as a sandy spit, which is nearly dry at low-water, extends almost across it, but otherwise it is safe and deep. It falls into Brewer's Strait, and this probably is the reason why it has no bore, like the other rivers along the north-eastern coast of Sumatra. The tides rise about 12 feet at full and change, and their velocity is about two miles and a quarter per hour.

The Kampar falls into the Strait of Malacca at its most southern extremity, nearly opposite the Strait of Singapore. Its upper course lies within the mountain-region, or at least it drains a hilly country, which may be inferred from the great quantity of coffee which is brought down the river and sent to Singapore. It is said to be formed by two large branches, which unite near its mouth, and each of these branches runs for twelve or fourteen days' journey through a well-cultivated country studded with villages, and is navigable for large boats. The harbour at the mouth of the river is not much visited by European vessels, on account of the velocity of the tides, which rise 15 feet, and run from four to six miles per hour. They produce a considerable bore. The coffee and other articles of trade are brought from this river to Singapore by the Malays in boats of 50 to 200 pekuls burden, which is equal to from 4 to 16 tons.

The next river is the Indragiri, which falls into the Strait of Durian opposite the island of Lingin, and appears to be still larger than the Kampar or the Siack river. It rises in the centre of Menangcabau, in the lake of Sinkara, a little more than 1000 feet above the sea-level, and runs about 100 miles within the mountain-region in a south-eastern direction. Its exit from that region is marked by a cataract near a place called Saluka. It is not known whether the river is navigated above the cataract, but probably it is so, for large boats from 5 to 20 tons burden are used below it. At Lubok Ramo-ramo, about 60 miles lower down, the sloop-navigation begins, and is not interrupted. The mouth of the river is very wide, but subject to a very dangerous bore: it is rarely visited by European vessels, but the Malays bring from it great quantities of rice to Singapore. The whole course of the Indragiri probably is not less than 300 miles.

The Iambie river drains a great extent of country: according to the best maps, all the waters from the eastern part of the mountain-region between 1° and 2° 30′ S. lat.

find their way to it. One of its upper branches rises in St. George's Lake, in the country of the Korinchi. The several branches which flow from the mountains unite nearly midway between the mountains and the shore, about 100 miles from the mouth of the river. To this place large vessels may ascend, or at least to the town of Iambie, which is 60 miles from the sea. Below the town the river divides into two arms, which unite about 30 miles lower down, and enclose an island about 10 miles wide. Not far from the place where the river begins to run in one channel it divides again into two arms, which enclose a large delta. The western arm is called Qualla Nior, and the eastern Qualla Sadda, and both of them divide again as they approach the sea. Only the most eastern and western arms are navigable for vessels of small burden, and even in these the navigation is intricate and dangerous, on account of the shoals and sand-banks. This river however has no bore, which is probably owing to the circumstance that its embouchures run northward into the sea, and are protected by the projecting cape called Tanjong Bon, or Jabon, from the swell of the sea.

The largest river of Sumatra is the Palembang, whose numerous upper branches originate in the mountain-region between 2° 30′ and 5° S. lat. The most southern of them brings down the waters of the large lake of Ranan, but this branch is little known. The best-known of these rivers is that which rises in the district of Musi, immediately at the back of the range of hills visible from Bencoolen, and, on that account, has the name of Ayer Musi in the early part of its course, but in the lower is named the Tatong. The Musi river becomes navigable for boats before it leaves the mountain-region at Muara Mulang, which is about 250 miles from the sea. Most of the southern districts of the mountain-region send their goods to Palembang, and receive by this river those foreign articles which are consumed by the inhabitants. Most of the branches fall into the Tatong in the vicinity of the town of Palembang, where the river is above a mile wide, and is navigated by vessels not drawing more than 14 feet. Vessels of a larger description may navigate it, but they meet great difficulties on account of the numerous shoals. From Palembang downwards the river is called Palembang river. After the confluence of its numerous branches it turns northwards, and begins to divide into several arms, reaching the sea with four mouths, which, with the intervening islands, occupy a space of more than 24 miles on the shores of the Strait of Banca. These arms are called from east to west Salsee river, False river, Palembang river, and Salt river. The depth of these rivers varies between 3 and 10 fathoms; but in front of their mouths is an extensive bank of hard sand, with a thin superstratum of black mud, which is hardly covered at low-water. The channels across this bank have only from 1½ to 2 fathoms at low-water. At the full and change of the moon the tide rises from 7 to 8 feet.

The Tulan Booang is the most southern of the larger rivers of Sumatra. It rises also in the mountain-region, but very little is known of its course, and nothing has been noticed respecting its navigability.

Climate.—The great equability of temperature on all the coasts and lower parts of Sumatra is mainly owing to the circumstance of the island being comparatively narrow, for the wind which comes directly from the sea is not so warm as that which has passed over large tracts of land in tropical countries. On the west coast, south of the equator, earthquakes are frequently felt; but in general they are very slight, compared with those of South America and other countries. Marsden however mentions one which was experienced at Manna in 1770, and produced great changes in the surface of a considerable tract. Waterspouts are very frequent along the western coast.

Productions.—Rice is cultivated in the lowest plains and in the elevated valleys of the mountain-range. The kinds of rice are very numerous; but all are divided into two classes, upland or dry rice, and lowland or marshy rice: the former is less prolific, but more valued. Sometimes the produce is so great that it yields 140 times its seed, but generally only 30 for one. Rice forms an important article of export from Acheen to Hindustan, and from the north-eastern coast to the British settlements on the Strait of Malacca. No other grain seems to be cultivated, except maize. Neither wheat nor millet is cultivated. The most common esculent vegetables are different kinds of yams, both red and white; the St. Helena yam, sweet potatoes, common potatoes only in the more elevated districts; bredy a kind of spinach; lobuck, or the Spanish radish; the large purple brinjall, or egg-plant; and many different sorts of beans, with white and green peas, and onions. The peas and onions are articles of export from the north-eastern coast to Penang and Singapore. Chili or capsicum, tumeric, ginger, coriander, and cummin-seed, are raised, especially on the western coast. Hemp is extensively cultivated, but only for smoking with tobacco. Tobacco is also grown, and is an article of export from the harbours on the north-eastern coast. Melons are raised on the plains, and sometimes attain an extraordinary size. Sesamum is cultivated for its oil; and the Palma Christi, from which castor-oil is obtained, grows wild. The sugar-cane is only cultivated for chewing; no sugar is manufactured, but it is imported from Java. The plantations of betel-vines are extensive. Indigo and cotton are raised for domestic use only.

Sumatra, like all the islands of the Indian Archipelago, is noted for the variety of its fruit-trees. The most important is the cocoa-nut tree, which grows even in the districts whose elevation does not much exceed 1000 feet above the sea-level, as in Menangcabau. There are also plantations of plantains, banana, the bread-fruit tree, jack-tree, mangusteens, durians, mango, different kinds of orange and lemon trees, especially the shaddock: the pine-apple, the jambo, the guava, the papaya, the custard-apple, the pomegranate, and the tamarind. European fruit-trees do not succeed: vines have been planted by Europeans, but with indifferent success. Besides these fruits, which are cultivated, Marsden enumerates fifteen kinds which grow wild and bear edible fruit. A dwarf species of mulberry is planted for the silk-worms, which are reared, but not to any extent: raw silk is imported from Singapore.

Other plants and trees are cultivated as producing articles for exportation. The most important is the pepper-vine, of which extensive gardens occur all over the island, except in the most elevated districts. From no other country on the globe are such quantities of pepper exported. The second as to importance is the areca-palm, which is grown most abundantly on the coast between Acheen Head and Diamond Point. On the eastern coast the plant from which gambier is obtained is largely cultivated. Coffee has lately been cultivated to a great extent on the shores of the Kampar river and in Menangcabau. Sago is grown in several places on the eastern plain, but especially on the island of Rantau: large quantities go annually to Singapore. In 1798 the English brought from the Moluccas the clove and nutmeg trees, and planted them on the west coast, near Bencoolen, where they succeeded so well, that a considerable quantity of mace and cloves was exported before the Dutch got possession of this coast: the nutmegs do not attain the size of those from the Banda Islands.

The tree from which the camphor-barus is obtained grows only in the northern districts, between 0° and 3° N. lat., north and south of the town of Baroos, from which the article has received its distinguishing name. This expensive article goes to China by way of Singapore. The wood is much valued for carpenters' purposes, being easy to work, light, durable, and not liable to be injured by insects. In the same district the tree grows from which benjamin, or benzoin, is obtained; and those which yield cassia. Dammer, a kind of resin, which flows from several kinds of trees, is collected abundantly. In most places there are the dragon's-blood trees, and some kinds of trees from which caoutchouc is obtained. Agila-wood is common. Extensive tracts of the eastern plain are covered with different kinds of canes, known by the general name of rattans, large quantities of which go to Europe and China. The forests, which cover perhaps more than three-fourths of the island, contain an inexhaustible store and endless variety of timber-trees, but the teak-tree is not among them. The most useful are the poon, used for masts and spars; the marbau, used as beams for ships and houses; the iron-wood tree, the ebony-tree, and the rangi, which resembles mahogany. Timber is occasionally exported to the Dutch or English settlements. Sapan-wood, lacca-wood, and some dye-wood go to Padang and Singapore from the eastern coast.

The most useful of the domestic animals is the buffalo, which attains an extraordinary size. It is generally used for agricultural purposes and as an animal of burden. There are two kinds, white and black. The flesh is eaten, but that of the black kind is preferred. The milk is employed in making butter. Black cattle are not numerous, except

on the coast of Pedir, where the plough is drawn by oxen. The horse is of a small breed, but well made and hardy. Those of the coast of Pedir are larger, and exported to the British settlements, where they are much valued. Sheep are few, and of a small size. Goats are numerous, but they are also small. A kind of wild goat found in the forests is much larger. The hog is of the Chinese breed. Few domestic animals are kept by the inhabitants of the great plain.

Elephants are very numerous, especially in the forests of the plain, but they have not been domesticated. The natives kill them with poison for the tusks and skin. The buffalo is found in a wild state. The rhinoceros is common, both that with a single horn and the double-horned species. The hippopotamus is rare. Bears are numerous, and among them is the sun-bear. There are different kinds of deer, among which is that diminutive animal the kanchil, called by Buffon 'chevrotin,' whose extreme length is only sixteen inches, and the height ten behind and eight at the shoulders. The wild hog and the hog-deer are frequently met with. The varieties of the monkey-tribe are innumerable, and among them the orang-utan is met with. There are sloths and squirrels. The tiger is very large, and frequently destroys men and most animals. There are also tiger-cats, civet-cats, polecats, porcupines, hedgehogs, and pangolins, a species of *manis*. Bats are very numerous. Alligators abound in most of the rivers. There are several species of lizards, of which the guana is eaten. Chameleons and flying lizards (*Draco volans*) are frequent. Snakes occur in great variety, among which is the boa. A few of them are poisonous. The turtle is found in the sea; but the land-turtle is imported from the Seychelles Islands. There is a great variety of shell-fish, among which is the gigantic keema (*chama*) in Tappanooly Bay, which is more than three feet in its longest diameter, and more than two feet across. The shell is perfectly white, several inches thick, and worked by the natives into armlets. Oysters are frequently found adhering to the roots of the mangrove-trees with which the coast is lined, especially towards the south.

No part of the ocean is so abundant in fish as the sea which surrounds the Indian Archipelago; but fish seem to be less plentiful on the western than on the eastern coast. Many families on the shores of the Strait of Malacca, and on the coast of Pedir, subsist by the produce of their fishing. The largest fishery is in Brewer's Strait opposite the town of Boikit Batu, where about 100 boats are engaged at all seasons in fishing the trubu, which is a fish about a cubit long; the roe is an article of trade, and the dried fish are sent into the interior of the island. In the Strait of Malacca is the dugong (Halicora dugong) and great numbers of sharks, the fins of which are exported from the north-eastern coast to Singapore, whence they go to China.

Besides the common fowl, which is as abundant as in most other countries, there is a much larger kind of domestic fowl in the Lampong country, where there is also that diminutive kind called the bantam. The wild-fowl which is found in the woods differs little from the common sort, except in the uniformity of its brown colour. Among the wild birds the Sumatran pheasant is conspicuous for its beauty. Peacocks, eagles, and vultures are very rare, but kites, crows, and jackdaws are very common, as well as woodpeckers and kingfishers. The hornbill is abundant. There are several species of storks, pigeons, and doves; and quails and partridges are common. The swallow which builds the edible nest is only found in a few places along the west coast. There are also parrots, the Indian goose, the duck, and the teal.

The island swarms with insects. The variety of ants is astonishing. Bees are very abundant, but the honey is inferior to the English: wax is exported from almost every trading place of the coast. The silk-worm is reared in a few places.

Sumatra was once noted for its gold, and a considerable quantity is still exported. The places in which it abounds are the mountains which surround the table-land of Menangcabau, but it is also found south and north of that country. The largest quantity goes from the mountains to the east coast, where it is exported to the European settlements and Southern Asia. Tin occurs in several places on the great plain, but is very little worked, as large quantities are obtained in the island of Banca [BANCA], where it is got with less labour. Copper is found in the northern portions of the mountain-region (between 2° and 3° N. lat.), to the south-east of Analaboo, where it occurs in great abundance in an extensive tract: it contains gold, but is not much worked. There is iron of superior quality in the mountains of Menangcabau, where it is worked to a small extent, and also made into various articles. But English and Swedish bar-iron are imported, especially on the eastern coast. Sulphur is obtained from some of the volcanoes, and arsenic is found in several places, and is an article of trade. Saltpetre is extracted from the earth of some caves near the banks of the river Kataun, but is of inferior quality: it is used by the natives for making gunpowder. Coal has been found in one or two places on the western coast, but it is of inferior quality. Very little salt is made, but large quantities are imported.

Inhabitants.—The interior of most of the larger islands of the Indian Archipelago is occupied by a race of negroes called Australian; but it does not appear that such a race is found in Sumatra. Marsden indeed mentions two different races which are dispersed in the woods, and avoid all communication with the other inhabitants, and he says that they are called Orang Kuba and Orang Gugu. They live in the tract that separates the country of Labung from Palembang, speak a peculiar language, and eat whatever the woods afford. The bodies of the Gugu are said to be covered with long hair, so that they resemble the Orang-utan. Another race is mentioned as inhabiting some mountainous tracts near Samangka Bay. They are called Orang-Abung, and nothing is known of them, except that, according to their custom, no man can marry till he has brought to his chieftain the head of a stranger.

If these small tribes are not the remnants of the aborigines of the island, the present inhabitants must be considered such. They all belong to the same race. Their languages also may be considered as dialects of the same original language, though they have adopted different modes of writing them. There are however some differences in these points, which have led writers on this subject to divide them into five nations: the Acheenese, the Battas, the Malays, the Sumatrans, and the Lampongs.

The Acheenese occupy the most northern part of the island, and differ considerably from the other nations, being in general rather taller, stouter, and of a darker complexion. They are supposed to be a mixture of Battas and Malays with Chulias, as the natives of the peninsula of Hindustan are called, who have frequented the ports of this country in all ages. They are more active and industrious than their neighbours, and they resemble the Bugis, or inhabitants of Celebes, in address and dexterity in business. In writing they use the Malay characters. They are Mohammedans, and as they have much intercourse with foreigners of the same faith, the forms and ceremonies of their religion are observed with some strictness.

The Battas occupy the sea-coast on the west side of the island from the river Sinkel to that of Tabuyong, and extend across the island to the east coast; but their territories have been encroached upon by the Malayan and Acheenese establishments in the most convenient maritime situations. They are rather below the stature of the Malays, and their complexions are fairer. Horse-flesh they esteem the most exquisite meat, and for this purpose they fatten horses with great care. They have a language and written character peculiar to themselves: their language contains a smaller number of Malay roots than the other languages of the island. It is remarkable that those who can read and write are much more numerous than those who cannot; and still more, that a nation, who in this respect, and in their agriculture, dress, and manners, show that they have made great progress in civilization, should be fond of human flesh, and eat prisoners taken in war and criminals condemned to die. They have not embraced Islam, and are heathens: they acknowledge three deities as the rulers of the world. [BATTAS.]

The Malays occupy, to the exclusion of all other nations, the whole of the great plain, from the river Rakan on the north to that of Masusi on the south, and also the shores north of the Rakan river as far as Timian. It does not appear that they are in possession of any part of the mountain region, except the country of Menangcabau. This mountain table-land was, according to the history of the Malays, the original seat of their nation, and from it they are supposed to have spread over the Indian Archipelago. [MALAYS.] The inhabitants of Menangcabau are still dis-

tinguished from all other nations of Sumatra by the advanced state of their agriculture, their manufactures, and civilization; while the Malays, who inhabit the shores of the Strait of Malacca, appear to be a degenerated tribe, and are chiefly occupied in piracy. The Malays who inhabit the country of Palembang however show greater diligence in cultivating the ground, and in several branches of industry, which is attributed to the circumstance that this part of Sumatra was for a long time subject to the kings of Java, during which period many Javanese settled in the country. The Malays are Mohammedans, but not strict observers of the ceremonies of their faith.

The name of Sumatrans comprehends all the tribes that inhabit the west coast, from the river Tabuyong (40′ N. lat.) on the north to the river Padang-guchi (4° 40′ S. lat.) on the south, and also occupy the mountain-region south of Menangcabau as far as 5° S. lat. They are rather below the middle stature. Their limbs are generally slight, but well shaped, and particularly small at the wrists and ancles. Their eyes are uniformly dark and clear; the eyes of the southern women particularly bear a strong resemblance to those of the Chinese, being narrow and somewhat lower at the inner angles. The hair is strong and of a shining black. The men are beardless, but they naturally have a beard, which however they take great care to eradicate as soon as it appears. Their complexion is yellow, and much lighter than that of the Hindus. In those of the superior class, who are not exposed to the rays of the sun, particularly in their women of rank, it approaches to fair. It seems that they speak several dialects, which contain a great number of Malay roots; and accordingly they are only considered as dialects of that language, but in writing them they use characters different from the Malay. Many individuals have been converted to the Mohammedan faith, but the remainder are heathens, and have no kind of religious ceremonies.

The Lampongs occupy the most southern part of the island, both the mountain-region south of the river Padang-guchi and the plain south of the river Masusi. They have a strong resemblance to the Chinese, particularly in the roundness of the face and the form of the eyes; otherwise they do not differ in their persons from the Sumatrans. They are the fairest people in the island, and the women are the tallest and handsomest. Their language differs considerably, though not essentially, from that of the Sumatrans, and contains a great number of Javanese words, the Javanese having been in possession of the greater part of the country for some time. In writing they use characters peculiar to themselves. The Mohammedan religion has made considerable progress among them, and most of their villages have mosques, but they have still preserved some superstitions of their old religion. Nearly all the nations inhabiting Sumatra are on a level with respect to civilization. The most advanced are those of Menangcabau and of Acheen, who in no respect appear to be inferior to the Javanese, the most civilized nation of the Indian Archipelago, in agriculture, the arts of civilized life, and even in literature, though respecting the last-mentioned point our knowledge is far from enabling us to form a correct judgment. The other nations are certainly a degree lower in civilization, but this is chiefly to be ascribed to the defect of their political institutions.

According to the history of the Malays, the whole island was once subject to the sovereign of Menangcabau, and this assertion is strongly supported by the veneration which is still shown by nearly all the inhabitants towards those who are connected with the reigning family of that country. From the advanced state of civilization of the inhabitants of Menangcabau, we may infer that the whole island must have been in a much more advanced state when their sovereigns extended their sway over all Sumatra. At present there is in most parts hardly a political union. Every village or town has its chief, who acknowledges only nominally one of the princes or sultans, of which there are several in the island, but he acts quite independently, and makes war on his neighbours as often as he pleases. There is an almost uninterrupted state of war, the consequence of which is that the condition of the people retrogrades. The influence which now for more than a century has been exercised by the European settlers and governments has been attended by the happy effect of diminishing these petty wars and promoting peace among the natives.

According to the latest estimate, the population of Sumatra is stated at four millions. Though the data which we possess are few, and refer only to a small portion of the island, we think that this estimate is certainly not too high, and will eventually turn out to be much too low.

Political Divisions, Towns, and Places of Trade.—Sumatra is partly subject to native sovereigns and partly under the sway and influence of the Dutch. The independent states lie on the north-eastern coast, along the Straits of Durian and Malacca, from 2° S. lat. to the most northern extremity of the island, and extend along the south-western coast as far as 2° N. lat. The remainder of the south-western coast, with a considerable part of the mountain-region, and the north-eastern coast as far north as 1° 30′ S. lat., is either immediately subject to the Dutch or governed by princes dependent on them. The independent states are Acheen, Siack, Indragiri, and Iambie on the coast, and that of the Battas in the interior.

1. *Acheen* occupies the most northern part of the island. When its government was in full force, it extended as far as the town of Baroos on the south-west coast, and as far as the river Batu Bhara on the east coast. It terminated in the interior at the mountains, in which the Sinkel river rises, and where the Batta territories begin. In course of time the powerful vassals on the east coast obtained their independence, but those on the north and west coast are still considered subjects of the king of Acheen, though they frequently refuse to pay their tribute. The area of the whole country is probably 20,000 square miles. A short description of it and of the capital is given under Atcheen. The capital is the principal seaport, but there are several other ports, which are annually visited by some foreign vessels, and also carry on a considerable commerce in their own ships. On the coast between Acheen Head and Diamond Point, from west to east, are the harbours of Acheen, Pedada, Lawang, Pedir, from which the whole tract is called the Coast of Pedir, Pakan, Selu, Burong, Sarong, Murdoo, Samalangan, Passangan, Junka, Teluksamoy, Chunda, Passy, and Curtoy, among which those of Pedir and Teluksamoy, next to the capital, are the most thriving and commercial. The chief article of export from these ports is areca-nut. Along the south-west coast, from north to south, are the harbours of Pulo Ryab, Annalaboo, Senangkan, Tarang, Taddow, Tareepuli, Scimeyon, Qualla Battoo, Soosoo, Manghin, Labuan Haji, Telapow or Tallapow, Sama Dua, Tampat Tuan, Kavalat, Saluhat, Pulo Dua, Rambong, Sebadi, Tarooman, Ayam Dammah, Sinkel, at the mouth of the river of that name, and Tapoos. Large quantities of pepper, benzoin, and camphor-barus are sent from these ports. The chief trade of Acheen is with the British settlements in the Strait of Malacca, and especially Penang; but there has also long existed a direct commercial intercourse between it and Bengal, Madras, and Bombay. Besides this the ports are visited by American vessels, French ships, Arabian vessels from Mocha and Jidda, Parsee vessels from Surat and Bombay, vessels from the Maldive Islands, and Portuguese vessels from Macao and Goa. Some English ships bound directly for China take in parcels of areca-nut for that country. In 1823 twenty-seven American vessels obtained cargoes on the western coast, chiefly pepper in exchange for Turkish opium and Spanish dollars, to the value of about a million of dollars. The articles of export, according to their value, range as follows: areca-nut, pepper, camphor, benzoin, gold-dust, Acheen piece-goods, dammar, rattans, bees'-wax, rice and paddy, elephants'-teeth, and tobacco. Minor articles are brimstone, buffalo-hides, coir rope or gumooty, fish-maws, oil and ghee, shark-fins, and sandal-wood. The amount of these articles brought from the ports of Acheen to Penang in 1837-38 was somewhat more than 400,000 Spanish dollars, and perhaps an equal amount was shipped for Calcutta and Madras. If the articles sent to Malacca and Singapore are added, it is very probable that the export trade to the British possessions in the Straits of Malacca and in Hindustan does not fall short of a million. In exchange for these articles there are imported opium of Bengal and Malwa, and the manufactured goods of Hindustan and Great Britain, such as piece-goods from Coromandel, broad-cloth, chintzes, white cloth, carpeting, iron, steel, cutlery, brass-ware, arms and ammunition, China goods, stick-lac from Ava and Siam, salt and salt-fish from the Maldives. Four or five large Arabian vessels from Jidda, Mocha, and Surat touch annually at Acheen, landing pilgrims on their return from, and conveying others to

Mecca, to the number of one thousand. They import salt, dates, and Surat piece-goods.

The countries south of Diamond Point, which were formerly subject to the sultan of Acheen, but at present are governed by their own independent rajas, or sultans as they are called, contain several ports, among which those of Langkat, Balu, China, Delli, Sardang, Batu Bhara, and Assahan are the principal. The sultans of the four last places are nominally dependent on the king of Siack. It appears that the authority of these petty princes does not extend far from the sea, as the inland country is inhabited by the Battas, who however send the greater part of their produce to these ports in exchange for foreign goods. Pepper is the great staple of the four first-named places, but some other articles also are exported, to a considerable extent, as rattans, rice, paddy, and several kinds of pulse, especially white and green peas, gambier of very good quality, especially that of Balu China, ivory, gold, tobacco, bees'-wax, and dragons'-blood. The imports, besides opium and salt, consist of a great variety of manufactured goods, as coarse China-ware, gold-thread, white cotton-cloth, coarse country cloth, broadcloth, ironmongery, tin, sabres, blunderbusses, swivels, gunpowder, looking-glasses, brass-plates, Pulicat-cloth with handsome borders, palempores, silk and gold wrought cloth from Tringano, Palembang, Siack, and Batu Bhara. The commerce of this coast with Penang is very active, especially that of Balu China and Delli. These two places are only a few miles from each other, and each is built on the banks of a river, which is navigable for brigs to the town, and for large boats to a considerable distance from the sea. The advantages of this easy navigation have attracted the whole commerce of the country of the Battas to these two harbours. Traders from the interior (as Allas and Gacoa) and even from the banks of the Sinkel river and other places near the south-west coast, come over with various articles and carry back manufactured commodities. By the Balu China river, which is navigable to Soonghal, the interior of the Batta country is supplied with such goods. Sardang, which is only a few miles south of Delli, has only a harbour for small vessels, but it exports some articles which do not grow in the plain, as camphor, benzoin, and gold dust: these articles are brought from the mountain-region of the Battas. Batu-Bhara is the largest and most populous place on the north-east coast. The surrounding country produces only rattans, salt-fish, horses, and slaves, as articles of export. But Batu Bhara is a free port, and mostly inhabited by merchants and shipowners. It is stated that 600 large trading boats belong to this port. These vessels are the carriers of this coast. They go in great numbers to Sardang, Delli, Batu China, Langkat, and other pepper ports, and to Assahan, from whence they bring large quantities of produce to Penang. Batu Bhara is also a manufacturing place: large quantities of fine silk-cloth are made here, which is in great esteem in all the neighbouring countries, and largely exported. Considerable quantities of raw China silk are imported into Batu Bhara. The last place on this coast is Assahan, which had formerly a much more active commerce than at present, but even now 80 large boats belonging to the country are engaged in conveying the produce of the well-cultivated tract on both sides of the river to Malacca and the other British settlements on the strait, besides many from Batu Bhara, which come to Assahan to procure rice and paddy. No pepper is grown in the neighbourhood. The exports, besides grain, consist of an immense quantity of rattans, wax, dye-wood, horses, dragons'-blood, and tobacco.

2. *Siack* is the largest state on the north-east coast, extending from the vicinity of the Assahan (3° N. lat.) to the river Kampar (0°), and being bounded by Indragiri to the south, by Menangcabau on the west, and by the Battas and Assahan on the north. It is considered to extend even to 4° N. lat., but the chiefs of the tribes between Assahan and Delli are only nominally dependent on it, and even those south of 3° N. lat. are frequently at war with the king. The trading-places within this large tract are, from north to south, Bila, Panai; Tanah Puteh, Kubu, and Rakan, on the Rakan river; Bukit Batu on Brewer's Strait, Siack on Siack river, and Pulo Lawang on the Kampar river. The trade of the five first-named places is not important. Bukit Batu has no commerce except in the roe of the trubu and in dried fish, the produce of its fishery. The town of Siack is situated on the right bank of the river of the same name, about 65 miles from its mouth. It was a place of great trade twenty years ago, and though the trade has greatly decreased owing to the continual internal wars, it still sends many vessels to Malacca and Singapore with rattans, dammar, gambier, dye-wood, ebony, agila wood, wax, ivory, silk, cloth, camphor, salt-fish, fish-roes, and gold. Coffee also has lately become an article of export. Formerly at least three pekuls of gold-dust were annually exported, but this article, which was obtained from Menangcabau, has greatly decreased. The imports consist of cotton-cloth from the neighbouring countries, which is called coast cloth, chintzes from Surat and Europe, white cloth from Europe, raw silk and cotton, silk stuffs, especially taffetas, gold-thread, gum-lac, coarse plates and dishes, cooking-pots from Siam, called *quallies*, iron and steel in bars and tubs, Java tobacco, precious stones from Ceylon, gunpowder, tin, muskets, and swivels. The most important articles are salt and opium. Occasionally a large quantity of timber is exported from Siack to Penang. Pulo del Lawang and other places on the Kampar river have lately risen into notice as trading-places on account of the great quantity of coffee which is annually brought by numerous small fleets, consisting of from 10 to 12 prahus, to Singapore. The other articles of export, which however are not important, are gambier, bees'-wax, twine, cassia of an inferior quality, ivory, rhinoceros-horns, and rattans. In return are taken blue and unbleached Madras cloth, raw silk and cotton, and English shirtings; cambrics and chintzes, balick and imitation balick handkerchiefs and salendangs, camlets, lead, iron, steel, Chinese gold-thread, Java tobacco, and stick-lac. The islands which lie on the east of Brewer's Strait belong to Siack. The largest of them, Rankan, is low and marshy: it produces a large quantity of raw sago, which is imported into Malacca and Singapore for the manufacture of pearl sago.

3. *Indragiri* is a kingdom of small extent, comprehending only the countries on both sides of the river of that name, but extending to the very base of the mountain-region, where it borders on Menangcabau. Its territories are said to be fertile, and capable of producing abundant crops of rice, of which considerable quantities have within a few years been imported into Singapore. It exports nearly all the articles mentioned as exports of Kampar, but in smaller quantity. Opposite the mouth of the river is the island of Lingin, and from that island northward to the capes of Burus and Romania and the port of Singapore, the sea is literally strewed with islands and innumerable rocks. Such a sea is favourable to piracy; and as this extremity of the China Sea is much navigated, partly on account of the rich countries in its vicinity (Java, Borneo, Sumatra), and partly as being the great thoroughfare of the commerce between Eastern and Western Asia, the pirate nation of the Illanos or Lanus [PHILIPPINES, vol. xviii., p. 87), whose original country is the island of Magindanao, have pushed their settlements, which are found in all parts of the Indian Archipelago, as far as the shores of Indragiri, where they settled at a place called Rittoh 30 years ago, or less than ten years before the foundation of Singapore. This is the most western settlement of these pirates.

4. *Iambie* is the most southern of the independent states of Sumatra. The boundary-line between it and the Dutch kingdom of Palembang begins on the shores of the sea near 2° S. lat., and extends south-west to the mountain-region, where it terminates near 3° S. lat. The present capital, Tanapileh (chosen land), is situated a day's voyage above Old Iambie, which is 60 miles from the sea. The population is about 4000, among which there are fifty Arab families. The produce of the country is dragon's-blood, gambier, benzoin, and a variety of rattans, with some gold-dust. These articles are taken to Singapore, which supplies Iambie with Chinese and European coarse ware, as well as opium and Siamese salt, which finds its way hence into the interior of the island.

5. The country of the *Battas* occupies the interior of the island between 4° and 2° N. lat., and is only separated from the sea by a narrow tract of land, which is settled by the Malays and Acheenese, and governed by petty chiefs of those nations. In this country the greatest part of the camphor, benzoin, and cassia is collected which is exported from Sumatra, as also large quantities of pepper and ivory, with other articles: a small portion of these products goes to the numerous small harbours of Acheen on the south-west coast of the island, but the larger part is brought to Balu China, Delli, and Sardang, on the Strait of Malacca. The

country of the Battas is divided among many independent hereditary chiefs, who are frequently at war with each other.

The Dutch possessions extend perhaps over half the area of the island. The southern portion of the plain is subject to them as far north as a line which begins near the mountains in the vicinity of 3° S. lat., and on the shores of the China Sea terminates near 2° S. lat. The greatest part of the mountain-region south of 2° N. lat., though governed by their own chiefs, acknowledges the supreme authority of the Dutch government. It is not well known what parts of the last-mentioned region have still preserved their independence. As the larger part of these possessions has been acquired within the last 20 years, the Dutch government a few years ago thought it expedient to introduce a new political division into five regencies, Palembang, Lampong, Bencoolen, Padang, and Ayer Banghis. The first two are placed under the governor-general of Java, and the three last-mentioned regencies constitute the government of the west coast of Sumatra.

1. The Regency of Palembang comprehends the kingdom of that name, and though the king keeps his title, the country is under the administration of the Dutch regent, but the power of the regent is very much circumscribed by that of the native chiefs. The boundary-line between Palembang and Lampong is mainly formed by the river Masusi, which runs near 4° S. lat. This extensive country is thinly inhabited, the population being stated not to exceed 140,000 individuals; the town of Palembang however contains 25,000 inhabitants. The houses are of wood or bamboo, except the palace of the sultan and the principal mosque, which are of stone, and in the centre of the town. Though this place is about 70 miles from the mouth of the river, it carries on a considerable commerce, as the river is navigable for large vessels. It exports the surplus of its produce to Java, Banca, Rhio, and Singapore. The exports consist of gold-dust, ivory, rattans, pepper, gambier, resin, bees'-wax, benzoin, mats, and silk stuffs, dried fish and copper-ware: the imports are opium, salt, cotton-cloth, sugar, oil, gold-wire, iron and steel, ironmongery, cutlery, raw silk, tea, and some minor articles.

2. The Regency of Lampong comprehends that portion of the plain which lies south of the river Masusi, and that portion of the mountain-region which surrounds the bays of Lampong and Samangka. It terminates on the west near Flat Point. This part of Sumatra was formerly part of the possessions of the sultan of Bantam in Java, and passed with the other possessions of that monarch to the Dutch. The level part of the country is very thinly inhabited, and exports to Batavia only rice, pepper, and a little cotton. The only settlement of the Dutch, and the place where the regent resides, is Mangala, on the banks of the Tulan Booang. There is another settlement within the mountain-region on Lampong Bay at Telok Bitong. The inhabitants of this tract gain their subsistence partly by selling provisions to the vessels which sail through the Straits of Sunda.

3. The Regency of Bencoolen begins on the south at Flat Point, and extends northward to 1° 55′ S. lat., comprehending the greater part of the mountain-region which is subject to the Dutch. South of 5° S. lat. the coast is difficult to be approached, and only one small harbour exists at Croi; but farther north they are more frequent, as Kawur, Manna, Silebar, Bencoolen, Laye, Ipoo, and Moco-moco. From all these places pepper is exported, and this is almost the only article of export, with the exception of some gold-dust and dried fish. The imports are chiefly opium, salt, piece-goods, iron and steel. Bencoolen is the seat of the resident. [BENCOOLEN.] The population of this regency is estimated at 100,000 inhabitants.

4. The Regency of Padang comprehends the mountain-region and the west coast between 1° 55′ S. lat. and the equator. It therefore encloses the antient kingdom of Menangcabau, whose population Raffles estimated at more than a million, and which a few years ago was subjected to the Dutch. In this regency there are numerous mines of gold, of which those situated in the district of Tiga Blas-Kotta are considered as very rich, more especially those of Songui Pago and Si-Payong. They lie to the east and south-east of Padang. The exports of this regency consist of a large quantity of coffee and of pepper, with cassia, benzoin, and gold-dust: the imports are opium from Bengal and Malwa, cotton-cloth and handkerchiefs from Coromandel, raw cotton, salt, and tobacco from Java, and a few other articles. The town of Padang, the residence of the governor of the west coast of Sumatra, and of the regent of Padang, is a small but well-built place. Ayer Adji is a small port.

5. The Regency of Ayer Banghis comprehends the mountain-region and the west coast between the equator and 2° N. lat. Along the coast it extends somewhat farther north, as the town of Baroos is also subject to the Dutch. In the southern districts of the mountain-region also there are several gold-mines, especially in those called Rawer or Ran and Mandilling. The two best harbours of Sumatra, the bays of Ayer Banghis and Tappanooly, are within these territories, and there is a good harbour also at Natal. Ayer Banghis, the seat of the resident, is a new place, and was hardly known by name some years ago. Natal is rather a populous town, inhabited by settlers from Acheen, Ran, and Menangcabau, all of whom are engaged in trade. On the Bay of Tappanooly are a few European commercial settlements. The exports of this regency consist of gold, pepper, camphor, benzoin, cassia, and a few minor articles: the imports are those noticed under the regency of Padang.

Manufactures.—Nothing perhaps shows more clearly the advanced state of civilization of the inhabitants of Sumatra than their manufacturing industry. The most important manufactures are those of iron and steel, which are carried to a considerable degree of perfection in Menangcabau, where iron has been worked from time immemorial. The kris (dagger) blades made here are famous all over the Indian Archipelago. Common implements of agriculture and several kinds of tools are made. Large quantities of fine silk-cloth are made at Batu Bharra, and this branch of industry seems to be much attended to along the eastern coast, as raw China silk is imported at nearly all the trading-places. Silk-cloth is also made at Acheen. The manufacture of cotton-cloth was formerly equally extensive. Marsden commends many of these cloths for their fineness and the taste of the patterns; but though this branch of industry is still carried on in many parts, the produce in others has been superseded by the introduction of British cotton goods. Earthenware is made on an extensive scale at several places, especially at Menangcabau, whence Padang and Bencoolen are supplied with this article. The beautiful gold and silver fillagree-work made in this island has long been admired, though it is executed with very coarse and imperfect tools. There are goldsmiths at every trading-place on the west coast.

History.—Some writers are of opinion that Sumatra is the Taprobane of the Greek and Roman writers; but others, with more reason, apply that name to Ceylon. Marco Polo notices it under the name of Java Minor. The name of Sumatra occurs first in the travels of Nicolo di Conti, who visited it before 1449. It is not known whence this name is derived, and it is unknown to the natives. The Malay name of the island is Pulo Percha. The Portuguese navigators reached the coast of Pedir in 1509, under Diego Lopez Sigueira. At this time it appears that the antient kingdom of Menangcabau, which, according to the Malay history, extended over the whole island, had already been dismembered; but Acheen was then governed by a powerful king, who prevented the Portuguese from gaining a footing in the island, and even tried to expel them from the town of Malacca. In 1575 a fleet of the Acheenese destroyed the shipping of the Portuguese in the harbour of that town; and in 1582 another fleet tried to get possession of the town itself, though without success. From that time the kingdom of Acheen began to be distracted by internal wars, and continual discord between the sovereigns and the hereditary chiefs, and fell by degrees into insignificance. The Hollanders appeared first on the north coast towards the close of the sixteenth century, and the English in 1602. The pepper-trade was the great object of these two nations: the Dutch formed a settlement at Padang in 1649 or shortly before, and the English at Bencoolen in 1685. The English afterwards pushed their commercial establishments southward to the vicinity of Flat Point, and erected others at Natal and round the Bay of Tappanooly; whilst the Dutch increased theirs in the intermediate space. But the Dutch had also got a firm footing in the southern districts of the island. As allies of the sultan of Bantam, they had erected a factory on the river Tulan Booang, in the country of the Lampongs; and in 1664 had extorted permission from the king of Palembang to establish one in the capital of that country. Thus affairs remained to the year 1811. Both the Dutch and the English had acquired authority with the

petty chiefs who governed the countries adjacent to their settlements, not by force of arms, but by conciliatory means; and they had induced them to leave off the continual wars, and to attend to the cultivation of the pepper and other articles of export. In 1811 the Dutch possessions, together with the island of Java, fell into the hands of the English. Shortly before that event the Dutch had a quarrel with the king of Palembang; and to avenge it, the British, in 1812, sent an armed force to his capital, took possession of it, and obliged the king to surrender the island of Banca, where, up to that time, the Dutch had only had some mercantile establishments for the purchase of tin. [BANCA.] After the peace of Paris, in 1816, the Dutch colonies on the Indian Archipelago were restored to them, together with the island of Banca. Besides this, the Dutch acquired a right to the possession of the country of the Lampongs, which they derived from the English. That country had always been considered as an appendage of the kingdom of Bantam in Java. In 1813 the sultan of that country had voluntarily made over his sovereignty to the English government, in consideration of an annual pension of 10,000 dollars, and thus the country of the Lampongs came into the possession of the English; and, in 1816, of the Dutch. A few years afterwards the Dutch acquired the same right to the kingdom of Palembang. The king of that country had, in 1821, expelled the Dutch troops stationed in his capital, but was soon obliged to yield to the army which was sent against him, and to surrender his power to the Dutch government, though the country is still governed in his name. In 1824 the Dutch acquired the British settlements on Sumatra by treaty. These settlements had always been a burden to the East India Company: the expenses which they caused generally amounted to four times the revenues. On the other hand, the Dutch, after having recovered the possession of Malacca, found that their commerce in the Strait of Malacca was much confined by the English, who had a settlement on Pulo Penang, and established another in 1819 on the island of Singapore. [PENANG; SINGAPORE.] Thus the Dutch found it expedient to give up to the English the town of Malacca and some settlements in Hindustan in exchange for the British settlements on the west coast of Sumatra. The latest accession of territory to the Dutch possessions took place in 1835, in consequence of a war with the Padries. The Padries are a religious sect which began to appear in the country of Menangcabau about the beginning of this century. As the inhabitants of the country are Mohammedans, many of them go on a pilgrimage to Mecca. One Hadjee Miseken, who had been there, was, on his return from Mecca, the first teacher of the tenets of the Padries. He recommended the suppression of those practices which led to ruinous consequences, gambling, smoking opium, and drinking intoxicating liquors, to which vices he attributed the commission of murders, thefts, robbery, fraud, and the depraved state of society. For about fifteen or sixteen years this doctrine was propagated only by conviction and persuasion, and he acquired many adherents; but about 1815 or 1816 a society was formed among the principal adherents of this new doctrine, for the purpose of compelling the other inhabitants to conform. The wars which arose devastated for many years the country of Menangcabau and some adjacent districts. The fanatical Padries were mostly victorious, especially under the conduct of Tooaka Passumman, who subjected a large tract of country to his sway. It is said that several members of the antient royal family fell by his hand, and he cruelly oppressed those whom he had conquered. Some of the small chieftains who inhabit the country between Padang and Menangcabau applied to the Dutch for protection, and the Dutch government took up their cause. Though the issue of the war which thus commenced was doubtful for two years (1833 and 1834), the military skill of Europeans was superior to the fanaticism of the Padries, and the result has been that the whole country of Menangcabau is now included in the Dutch possessions. Thus the Dutch, in somewhat more than twenty years, have succeeded in founding an extensive empire in Sumatra.

(Marsden's *History of Sumatra;* Crawfurd's *History of the Indian Archipelago;* Heyne's *Historical and Statistical Tracts on India;* Anderson's *Account of a Mission to the East Coast of Sumatra;* Lady Raffles, *Memoirs of the Life and Public Services of the late Sir T. S. Raffles*, &c.; Moor's *Notices on the Indian Archipelago*, Singap., 1837; Anderson's *Acheen and the Ports on the North and East Coasts of Sumatra;* Hogendorp's *Coup-d'œil sur l'Isle de Java et les autres possessions Neerlandaises*, &c.; and Horsburgh's *Indian Directory.*)

SUMBA, SUMBAWA. [SUNDA ISLANDS, LESSER.]

SUMY, a large town in the government of Slobodsk-Ukraine, in European Russia, is situated in 50° 50′ N. lat. and 35° E. long., on the river Psol, at its junction with the Suma. It is surrounded by a wall and ditch, and has also an antient citadel. It has two stone churches and eight of wood, of which material most of the houses are likewise built. There are several charitable institutions, public depôts, and warehouses. The number of inhabitants is above 12,000, whose chief employments are tillage, gardening, pasturage, and distilling. They have no manufactures, but a considerable traffic in the productions of the country, especially at five great annual fairs, which are much frequented. At one of those fairs large purchases of horses are made on account of government for the Russian cavalry.

(Schneller's *La Russie et La Pologne;* Hassel; Hörschelmann.)

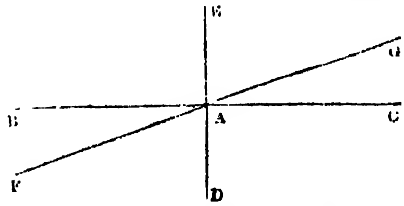
SUN (Latin, *Sol;* Greek, ἥλιος, Hēlios). In the present article we confine ourselves to the astronomical characters of the sun's orbit, and to what we know of its physical constitution. For more particulars on the measurement of time, see TIME; on chronology as dependent on this body, and on the more common characters of its motion, see YEAR. See also MOON; SEASONS; ASTRONOMY; ZODIAC (on mythology); ZODIACAL LIGHT; TWILIGHT, &c.

It is needless to say that if the utility of the subject of an article were to determine its length, the one we are now commencing ought in justice to occupy several volumes of the work: were we however seriously to mete out the importance of the sun in columns of a Cyclopædia, our panegyric would not be more quaint than that of Sir John Hill, who says that this luminary is 'enough to stamp a value on the science to which the study of it belongs.' In relation to astronomy this is particularly true; for it would be possible to preserve life on the earth, and to keep order, without any knowledge of the moon, planets, or stars; but to do this without any acquaintance with the sun's motions would be absolutely impossible. The source of light and heat, and through them of the alternations of the vegetable world, is, in the highest secondary sense, the giver and sustainer of life; but this very importance ensures names to so many results of solar phenomena, that the present article is stripped of details, by their entering more appropriately into others.

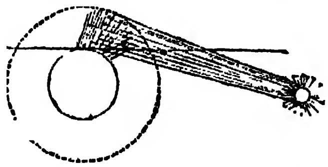
The motions of the sun are in fact those of the earth, written in the heavens. If the diurnal motion of the earth were stopped, the sun would appear to move slowly among the stars, from west to east, at the rate of about twice its own diameter in twenty-four hours by the clock. This [MOTION] is the consequence of the orbital motion of the earth, which is communicated in appearance to the sun. If the earth's orbital motion were stopped, the diurnal motion continuing as usual, the sun would appear to move round daily, from east to west, as at present; but since there would then be no motion of that body among the stars, those stars which are at any one time hidden by the daylight would always be hidden, and the face of the heavens at any given hour of night would be the same at all times of the year. The effect of the orbital motion of the earth combined with the diurnal motion is that the solar day, or the interval between two meridian passages of the sun, is a little longer than the sidereal day (about four minutes), or than the actual revolution of the earth; so that all the stars have their turn, and every star in the course of the year comes on the meridian at every period of the natural or solar day. [SYNODIC; TIME.]

The great phenomena of day and night are attended with very different circumstances in different parts of the globe. We are not speaking now of the high polar regions, north and south, in which the sun never sets for days together, but of those parts of the earth in which there is actual appearance and disappearance of the luminary, or real day and night. Let us take the day of the vernal equinox as a specimen, when the sun is in the equator (we presume in our reader a knowledge of the terms and notions in SPHERE, DOCTRINE OF THE). If we take one fixed line to represent the horizon of different places, as BAC, the sun will rise to a place on the equator so as to move along the circle DAE, and to come directly up from the horizon; while at a place near the pole it will move, relatively to the horizon (still

BAC), along the circle FAG. Now the first evidence which the sun gives of its approach is this (the diagram, though



very distorted dimensions, may be of use): before it has seen above the horizon of the place, so as to be visible, it



can throw its rays into the atmosphere above the place, which atmosphere reflects something both of light and heat to the place itself. This period is call the twilight, and it is said that there is more or less of twilight as long as the sun is not more than 15° below the horizon: though certainly the twilight which saves candlelight does not last so long. But, be the number of degrees which are allowed to twilight more or less, it is obvious that at the equator, where the whole of the sun's way is made directly to or from the horizon, the intermediate period of twilight must be much shorter than at a place near the pole, where the motion towards the horizon is very oblique, instead of being all ascent, as before rising, or descent, as after setting. The consequence is well known: in the tropics, the warning is short, and soon after the light begins to break the sun makes its appearance, and it is broad and hot day; while after the setting the light as soon disappears, and it is dark night. With us, on the contrary, and still more in higher northern latitudes, there is a long warning of the approach of the luminary before the sunrise, and a long remembrance of it after sunset. In all climates the transition from day to night is broken by the two circumstances mentioned in SEASONS. In the same article it is pointed out that the heat received during the winter and summer halves of the year is the same over the whole earth.

Immediately after sunrise, the form of the luminary appears somewhat elliptic, the horizontal diameter being longer than the vertical one. This is the effect of REFRACTION, which varies so rapidly near the horizon, that the upper end of the vertical diameter is less elevated than the lower end by a sensible quantity, while the two ends of the horizontal diameter are equally elevated. The same phenomenon occurs with the moon, when rising at the full, and would also be seen in the planets, if they were large enough in appearance. It must also be noted that both sun and moon appear larger when near the horizon: but this, as to the sun, is delusion, since when measured with instruments its apparent diameter is the same at all parts of the day. It is true that both bodies, when in the zenith, are nearer to the spectator than when in the horizon, by what may be called without error a semidiameter of the earth; the moon is near enough to show the effect of this in instrumental measurements of its diameter, but it is not so with the sun.

Before looking at what we know of the physical appearances of the sun, its distance from the earth must be mentioned, to which we may add at once the other elements of its orbit. Its equatorial horizontal PARALLAX, at its mean distance, is $8''\cdot5776$, and its apparent semidiameter $16'\ 0''\cdot9$. It is then distant from the earth by 24,000 semidiameters of the earth, or about 95 millions of miles. Its diameter is $111\frac{1}{2}$ times as great as that of the earth, or upwards of 880 thousand miles; and its bulk is 13 hundred thousand times as great as that of the earth. But its mass, as determined from its action on the planets, is only 355 thousand times as great as that of the earth; whence its average density is only one-quarter of that of the earth. But this last result takes into the body of the sun all that is seen of it: if the surmise presently to be mentioned, of its having a luminiferous atmosphere of considerable extent, be well founded, the real body of the sun may have as much density as the earth, or more. It revolves on its axis in $25\frac{1}{4}$ of our mean solar days; according to Delambre, in 25·01154 days: the axis being inclined to the ecliptic at an angle of $82\frac{1}{2}°$.

The ecliptic is the circle in which the sun appears to move, in common language. In strictness however the earth does not move round the sun in a true plane, though it does so very nearly. The centre of gravity of the earth and moon (a point near the earth) does much more nearly describe a plane; that is, a spectator situated at that point would more nearly see the sun move in a great circle than we do. But to us, the sun is sometimes on one side and sometimes on the other of this mean ecliptic; and therefore generally has some *latitude*, though a very small one: the column entitled 'the Sun's latitude' in The Nautical Almanac is a puzzle to those readers whose astronomy is drawn from the usual elementary writings: in truth, it is only a fraction of a second, and the sun crosses the mean ecliptic twice in every lunation. The obliquity of the mean ecliptic, for January 1, 1845, is $23°\ 27'\ 34''\cdot23$, and it is diminishing yearly by $0''\cdot457$: thus the same obliquity for January 1, 1842, is $23°\ 27'\ 35''\cdot60$. If this diminution could go sufficiently far, it would in time bring the ecliptic and equator to coincidence, or equalize days and nights all over the world; and if it could be held to have continued long enough, would entitle us to presume that the poles were once in the plane of the ecliptic, or that every part of the earth went through all gradations in a year from equal days and nights to a polar day and a polar night. But the cause of this diminution of the ecliptic is known from the theory of gravitation; and it is also known that, under existing causes, it cannot be permanent, but must diminish in quantity and finally turn into an increase before its effect has amounted to many degrees. Persons acquainted with the phenomena of the heavens, but not with the results of the theory of gravitation, remembering the fact of tropical productions being found buried in high latitudes, sometimes imagine that they can look back to the time when the poles were so near the ecliptic, that these same high latitudes were within the tropics. This however is a pure fancy, and they had better imagine another cause; the one they think of will not do.

The mean longitude of the sun, at Greenwich mean noon on the 1st of January of the year $1800+t$, may be determined from

$$280°\ 53'\ 32''\cdot75+27''\cdot605844t+\cdot0001221805t^2-14'\ 47''\cdot083f$$

where f is the remainder of t divided by 4, or 4 if the remainder be 0; that is, the number of years after the *Julian* leap-year, or after the *Gregorian* leap-year for all years after 1804. The mean motion in longitude in a mean solar day is $59'\ 8''\cdot33$.

The eccentricity of the sun's orbit is ·016783568 (according to Laplace ·01685318), or the greatest and least distances of the sun from the earth are in the proportion of 1·017 to ·983, or as 30 to 29, or more nearly as 91 to 88. The greatest equation of the centre [TIME] is $1°\ 55'\ 27''\cdot3$. The eccentricity diminishes by ·00004163 in a century.

The mean longitude of the perigee, at noon, January 1, 1801, was $279°\ 30'\ 5''\cdot0$. It has a real yearly increase of $11''\cdot8$, which, with the precession of the equinoxes, makes an increase of longitude of $61''\cdot9$.

The appearance of the sun is simply that of a ball of intense light, such as the human eye cannot bear, unless a hazy atmosphere or a dark glass be used as a screen. This light is so strong, that the brightest flames which human art can produce, when held before the sun, disappear, and ignited solids become dark spots. 'The ball of ignited quicklime,' says Sir J. Herschel, 'in Lieut. Drummond's oxy-hydrogen lamp, gives the nearest imitation of the solar splendour which has yet been produced. The appearance of this against the sun was however as described,' merely a dark spot, 'in an imperfect trial at which I was present. The experiment ought to be repeated under favourable circumstances.' A very small portion of the rays collected into one spot [BURNING-GLASSES] is sufficient to melt metals. On examining the face of the sun with a telescope (of course with a dark glass before the eye), two circumstances are observed. The disc is not uniformly bright. 'The ground is finely mottled,' to use the words of the observer just quoted, 'with an appearance of minute dark dots, or *pores*, which, when attentively watched, are found to be in a constant state of change. There is nothing which represents so faithfully this appearance as the slow subsidence

of some flocculent chemical precipitates in a transparent fluid, when viewed perpendicularly from above; so faithfully indeed, that it is hardly possible not to be impressed with the idea of a luminous medium intermixed, but not confounded, with a transparent and unluminous atmosphere, either floating, as clouds in our air, or pervading it in vast sheets and columns like flame, or the streamers of our northern lights.' The mind is lost in wonder at the idea of such a body of luminous material: but it is important to remember that living, as we must, under an atmosphere, we cannot positively assert anything as to what may take place beyond it. It is possible, though not very probable, that we should neither feel sensible of light nor heat, if we could meet the sun's rays before they have entered the air.

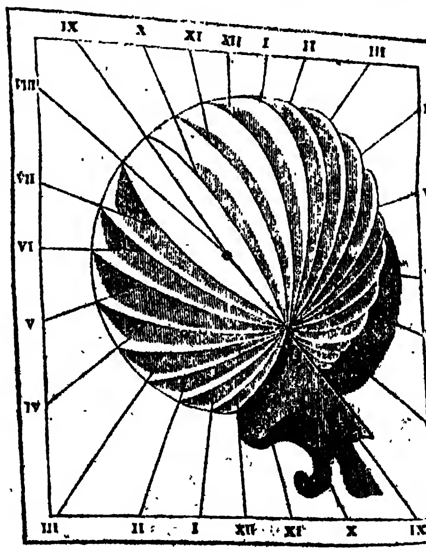
The other circumstance which is noticed on the sun's disc is the existence of black spots, by the regular motion of which the rotation of the body on its axis has been determined. These spots are of various irregular shapes, and are always surrounded by a border or penumbra, not so dark as the spot. They are of various sizes, from the least visible to the twentieth part of the sun in diameter. In their neighbourhood are frequently observed streaks on the disk more luminous than the rest, called *faculæ*, in which streaks spots frequently begin their appearance. The spots themselves alter in size, and gradually vanish, lasting various times, from a few days to six or seven weeks; the borders approaching each other in a manner which calculation shows must answer to hundreds of miles a day. Various theories have been invented to account for them, but none which has any appearance of probability, except that of W. Herschel (*Phil. Trans.*, 1801). He supposes that the sun has an atmosphere of greater density and depth than that of the earth; and that above this atmosphere, or else mixed with the higher strata of it, is another atmosphere of self-luminous clouds, of very variable depth, sometimes showing the lower atmosphere uncovered, which last reflects the light of the luminous atmosphere above it. A spot on the sun is a portion of the body of the sun itself, laid bare by some commotion which removes both atmospheres, or the greater portion of them: the penumbra round the spot, its never-failing attendant, arises from the ridges of the lower atmosphere, which form the banks of the opening. The faculæ, and general mottled appearance of the sun, arise from the luminous atmosphere having waves or ridges. From some measures of the light of different parts of the sun, Herschel thought that the non-luminous atmosphere reflects a little less than one-half the light it receives from the luminous atmosphere, and the solid body of the sun less than one-tenth. He also supposed that the presence of spots and other disturbances indicated a large formation of heat and light in the sun, and was a prognostic of hot weather and fine seasons. This he imagined he had verified by such comparisons as existed of the state of the sun at different times with the prices of wheat immediately following: he found that, as far as his data went (and he gives a proper warning as to their insufficiency), the price of wheat always rose when the sun was without spots, and fell when they began to re-appear. We have not heard of any extensive attempt to verify or refute this theory; but so far as the hypothesis of the two atmospheres is concerned, it is one of high probability: we could hardly ask for a likely result of such a combination which does not actually make its appearance. If it be correct, the sun may very possibly be a globe habitable by living beings, perpetually illuminated by its upper atmosphere, the lower atmosphere preventing too much of either light or heat from reaching them.

But as to the process by which this enormous manufactory is kept up, no theory gives the means of forming even a conjecture on the subject. Not but that conjectures have been formed: for example, it has been thought that comets carried supplies of the necessary material. That comets may occasionally fall into the sun is very possible; but as far as our knowledge of them goes, it would be as reasonable to expect that the steam-engines in our factories should be kept in repair by throwing their own cinders upon them, as that comets should supply what is needful for the maintenance of the solar rays.

SUNDIAL. Up to a comparatively recent period the science of constructing sundials, under the name of Gnomonics, was an important part of a mathematical course. As long as watches were scarce, and clocks not very common, the dial, which is now only a toy, was in actual use as a timekeeper. Of the mathematical works of the seventeenth century which are found on book-stalls, none are so common as those on dialling. All that is now necessary is to give some idea of the principles on which such instruments are constructed, as an illustration of a leading fact in astronomy. If a person were to place a staff in the ground, so as to point either vertically or otherwise, and to watch its shadow at the same hour, on different days at some intervals from each other, marking its direction at each day's observation, he would in all probability find that the direction of the shadow, the hour being always the same, varied from day to day. He might however find that the shadow was always in one direction at the same hour, and this might happen in two different ways. First, he might by accident fix the staff in a direction parallel to that of the earth's axis, in which case the direction of the shadow would always be the same at the same hour, at all times of the year, and for every hour. Secondly, having fixed the staff in a position not parallel to the axis of the earth, he might happen to choose that particular hour, or interval between two hours, at which the shadow of a staff in *that one direction* always points one way. But if, as is most likely, he were to fix the staff in a direction which is not that of the earth's axis; and if, as is again most likely, he were to choose any time of observation but one, the shadow would certainly point in different directions at different periods.

A sundial consists of two parts: the *style*, which is the staff above mentioned, usually supplied by the edge of a plate of metal, always made parallel to the earth's axis, and therefore pointing towards the north; and the dial, which is another plate of metal, horizontal or not, on which are marked the directions of the shadow for the several hours, their halves and quarters, and sometimes smaller subdivisions. In the accompanying diagram, the style is seen throwing its shadow between the directions marked IX and X, on the western side, and indicating that it is about a quarter past nine in the morning. But there is one prominent part of the figure which is never seen on a dial, namely, the hour circles, which are represented as all passing through the edge of the style. As the diagram stands, a skeleton globe of hour-circles only is made a part of the construction, to assist in the explanation.

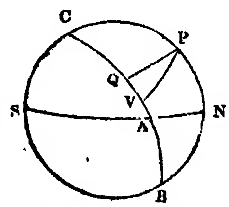
Let us suppose the sun to move with an equable motion so that it shows the same time as the clock. It does not do so in reality, but the consideration of this point belongs to the article TIME. A large sundial is frequently furnished with a table of the correction of sun-time, to turn it into clock-time, engraved on its face; but this is generally soon corroded. Nor is knowledge of the simplest elements of astronomy so widely diffused as to make such a table of any great use. A person who stations himself in any place of resort which has a sundial, will soon find a lounger who looks in amaze-



ment at the difference, perhaps a quarter of an hour, between his watch, which he knows to be right, and the shadow. The church-clock and the sun, in both of which he implicitly believes, are at variance, and he is hardly able to

resist the melancholy conclusion that his watch has gained or lost a quarter of an hour in a ten minutes' walk. Neglecting the cause of this, which is an irregularity of solar time, and has nothing to do with any particular mode of reading the results, let us suppose that it is nine o'clock in the morning, solar time. This means that the sun is in that hour-circle which belongs to three hours before noon, or is 3×15 or 45 degrees from the meridian hour-circle towards the east. The meridian hour-circle is that which cuts the plate of the dial in the line XII XII; and the hour-circle in question (the right-hand one of the two which are not shaded) cuts the dial-plate in IX IX. Now when the sun is in the continuation of any plane, the shadow of that plane is only that of the edge presented to the sun. The upper edge of the style is common to all the hour-circles; and its shadow is therefore, for the time, part of that of the hour-circle in which the sun is. Hence at nine o'clock before noon the line OIX will be the shadow of the style, O being at the intersection of the edge of the style and the dial-plate (marked by a large dot in the figure). In the diagram, the day has moved on about a quarter of an hour after the time just described, and the shadow has advanced accordingly. There is in it a trifling error of shading (it was taken from De Parcieux's Trigonometry, a work which is very rich in well-drawn solid figures), which will serve to illustrate the subject. The time being between nine and ten o'clock, the sun ought to be looking directly into the crevice between the hour-circles IX and X, in which crevice there ought therefore to be no shadow; but the crevice which is entirely devoid of shadow is that between the hour-circles VIII and IX, so that the sun is made to tell one story on the north side, and another on the south, of the figure. The reader will easily set this right, and will see that as far as the whole hours are concerned, the crevices themselves might be made to answer the purpose of a sundial.

Though the preceding figure was drawn for a horizontal dial, yet any other plane might be substituted. The objections to a dial are, that the shadow of the style is not sufficiently well defined to give very accurate results, even for ordinary purposes: that refraction, which always makes the sun appear a little too high, throws the shadow a trifle towards noon at all times, that is, makes the time too fast in the morning, and too slow in the evening; and that a correction is always necessary in order to find mean or civil time. Even if the first objection could be got over, the corrections requisite for the two latter would prevent persons in general from making use of the instrument. If the edge of the style be not very narrow, it is necessary to have the morning and evening halves of the dial separated by the breadth of that edge.



Those who understand spherical trigonometry will easily see that the general problem of a sundial consists in that of finding out where the hour-lines cut a given circle, as follows. Let BQC be the circle in which the plane of the dial produced cuts the heavens, and let the angle CAS, which it makes with the horizon (h), and CBN, which it makes with the meridian (m), be given. From P, the pole, draw QP perpendicular to the plane of the dial; and the line joining P with the centre being the continuation of the style, that joining the centre with Q is the continuation of what is called the *substyle*. Now in the right-angled triangle ANB, we have

$$\cos NB = \frac{\cos h}{\sin m},$$

whence NB is found; to which add the latitude of the place, PN, and PB is found. The equations

$$\tan PB \cdot \cos m = \tan QB, \quad \sin PB \cdot \sin m = \sin PQ$$

show how to place the substyle with respect to B, the point answering to noon: and also how to place the style with respect to the substyle. To find the point V at which any given hour-line, PV, cuts the circle CB, first find the angle QPB from

$$\cot QPB = \tan m \cdot \cos PB;$$

and VPB, the hour-angle from noon of the sun (V being a point in the shadow). The difference of these angles, QPV, or their sum, is then known; and QV is found from

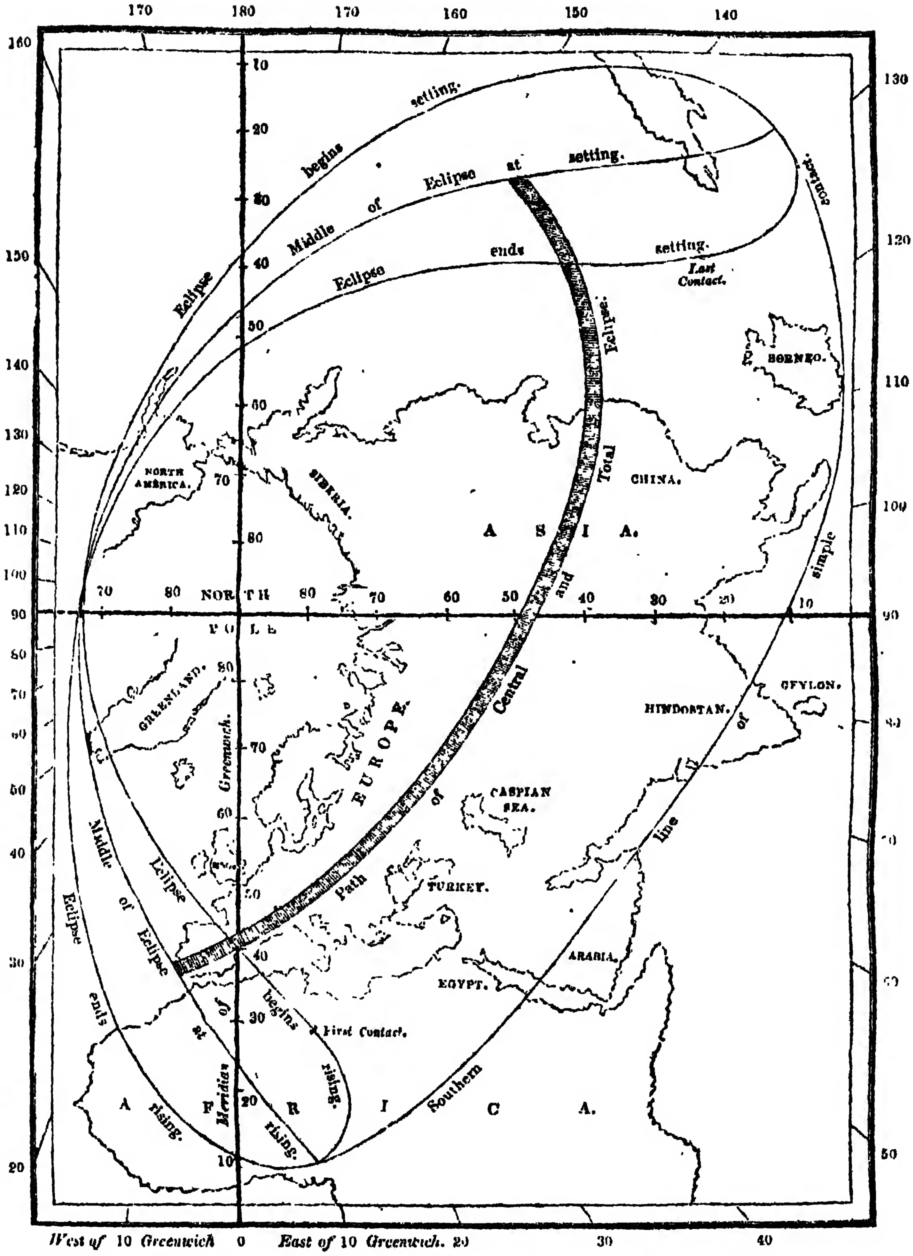
$$\tan QV = \tan QPV \cdot \sin PQ.$$

It will be better for the beginner to verify these steps on a correctly-drawn figure, or to modify them, than to make purely algebraical alterations. Also it is to be remembered that the position of the dial may require both sides of it to be graduated, and the style to extend in both directions, to suit all times of the year and all hours of the day.

SUN, ECLIPSE OF THE. The phenomena of an eclipse of the sun resemble those of the moon in one respect only, namely, that the body of the luminary disappears. In all other respects there is so great a difference, both in the cause of the phenomenon and its attendant circumstances, that it is a pity one term, eclipse, should be used in senses so different. In the first place, the disappearance of the moon arises from the earth intercepting the light which she ought to receive, while that of the sun is the consequence of the moon coming between the sun and the earth. The body of the moon is never absolutely hidden, and is even slightly visible through a telescope during the darkest eclipse: but the body of the sun is really hidden by the intervention of the opaque substance of the moon. Again, the phenomena of an eclipse of the moon are the same for every point of the earth at which they are visible: the beginning, middle, and end of the phenomenon happen at the same instant of absolute time everywhere, and the same portion of the moon is hidden from all the earth at the same instant. But in a solar eclipse, it entirely depends upon the position of the spectator whether there is any eclipse at all; and of two persons at different parts of the earth, at the same instant, one may see the sun totally eclipsed, while the other may, by the brightness of the sun's rays, not know that the moon is almost close to him. A screen held before a candle may be an eclipse of the candle for one person in the room, but not for another, on account of their difference of place; this is an illustration of the solar eclipse: a ball thrown into a dark corner may be invisible to all the persons in a room at the same time; this is the same illustration of a lunar eclipse.

If the earth had no motion of rotation, the inhabitants of any one place would see something exactly resembling a lunar eclipse; the sun being in place of the moon, and the moon in place of the earth's shadow. But different places would see different kinds of eclipses, some losing more of the sun's body, and others less. The rotation of the earth, without materially altering the character of the phenomenon, makes it much more difficult to calculate: for it is as if each spot of the earth, instead of standing still to witness one phenomenon, or one simple eclipse, were constantly taking into view portions of different phenomena, a part of one followed by a subsequent part of another. In an eclipse of the moon, whatever may be the phase for the time being, from the disappearance of the first to the reappearance of the last edge, the only question as to whether such phase will be visible or not at any place is the following:—Will the moon be above the horizon at that place when the phase occurs? Suppose, for instance, it were asked, what places on the earth will see the beginning of the eclipse, the disappearance of one edge of the moon, at the instant when the moon rises? The answer is, calculate the absolute instant of the beginning of the eclipse, find out the spot to which the moon is vertical at that instant, and all places 90° distant from it will be exactly in the same predicament with respect to the eclipse. But in an eclipse of the sun, the beginning at two different places does not happen at the same instant; the inhabitants of any the same circle see very different phases, and a line drawn through all the places which see the same sort of phase under the same position of the luminaries with respect to their horizons will be very different from a circle. Without attempting to give any account of the modes of ascertaining all these points, we subjoin, from the Nautical Almanac, a projection of the eclipse which is to take place on the 7th of next July, 1842.

The southern line passes through all the places which see a simple contact of the luminaries and nothing more: the edges of the luminaries unite for a moment and then separate. This line touches the two ends of a large figure of eight divided by another line passing through its loop; and the portion of the earth which at any time sees a total eclipse is contained in the broad shaded band. On the line marked 'beginning of eclipse at sunrise' live those to whom the luminaries rise in contact: the other lines are similarly explained. The eclipse is first seen at the place marked 'First contact' on the line just mentioned. One point is marked as having both beginning, middle, and end



Path of the Moon's Shadow and Penumbra over the Surface of the Earth during the total Solar Eclipse of July 7, 1842.

of the eclipse at sunrise: this means that the eclipse is there only a contact, so that its beginning, middle, and end take place at the same moment, and that moment is sunrise. At the loop of the figure of eight, the beginning, middle, and end are represented as each of them taking place both at sunrise and sunset: which must be a mystery to those who are not used to trace mathematical conceptions to their limits: are there two eclipses, one for sunrise and one for sunset? The explanation is this: there is at every moment of time a point in the arctic regions at which the sun is making its first appearance or its last appearance previously or subsequent to the long polar day or night. As this moment approaches the days shorten, if the disappearance be coming on, and begin from nothing if the appearance be coming on: the long day or night being preceded by the ordinary days or nights of the rest of the earth. Now the point which is at the loop is that point of the earth at which the sun and moon are in contact (without any further eclipse) at the moment when the sun first grazes their horizon after their polar night: so that their day is but a moment, and at that moment the contact takes place.

The figure of the projection is not always like that of the preceding: sometimes the loops become two ovals separated by a line which is continued through the middle of them, the part of this line between the ovals being a line on which nothing but a simple contact is seen.

There is an excellent mathematical account of eclipses in general, with the full mode of calculating them, and examples, by Mr. Woolhouse, in the Supplement to the Nautical Almanac for 1836. From this we extract the summary of the limits within which an eclipse, whether of the sun or moon, can happen.

At the time of full moon an eclipse of the moon will be certain when the moon's latitude is less than 51′ 57″, impossible when it is greater than 63′ 45″, and doubtful between these limits. For the doubtful cases an eclipse will result when the moon's latitude is less than

$$\frac{61}{60}(p+\pi-\sigma)+s+16'',$$

p and s being the equatorial horizontal parallax and semidiameter of the moon, and π and σ those of the sun.

At the time of new moon an eclipse of the sun will be certain when the moon's latitude is less than 1° 23′ 15″, impossible when it is greater than 1° 34′ 52″, and doubtful between these limits. For the doubtful cases, an eclipse will happen when the moon's latitude is less than

$$p-\pi+\sigma+s+25''.$$

It is hardly necessary to state that eclipses of the sun are frequently wholly partial, that is, not total for any one moment to any one part of the earth. Sometimes, though the eclipse be central, it is not total on account of the moon not being near enough to hide the whole of the sun: in which case part of the latter is seen as a bright ring round the part hidden by the moon, and the eclipse is called annular.

An appearance of a surprising character has been often observed in total and annular eclipses of the sun, as soon as the moon begins to leave or approach the internal border of the sun. In the former case the separation is not always instantaneous, but threads of black appear to connect the edge of the moon and sun, 'as if the edge of the moon were formed of some dark glutinous substance which by its tenacity adhered to certain points of the sun's limb, and by the motion of the moon was thus drawn out into long threads, which suddenly broke and wholly disappeared.' . . . 'The moon preserved its usual circular outline during its progress across the sun's disk, till its opposite limb again approached the border of the sun, and the annulus was about to be dissolved. When, all at once (the limb of the moon being at some distance from the edge of the sun), a number of long, black, thick, parallel lines, exactly similar in appearance to the former ones above mentioned, *suddenly darted forward* from the moon and joined the two limbs as before; and the same phenomena were thus repeated, but in an inverse order. For, as these dark lines got shorter, the intervening bright parts assumed a more circular and irregular shape, and at length terminated in a fine curved line of bright beads (as at the commencement), till they ultimately vanished, and the annulus consequently became wholly dissolved.' The preceding is from Mr. Baily's paper on the solar eclipse of 1836 (*Mem. Astron. Soc.*, vol. x.), in which an account will be found of preceding appearances of the same kind. Several other observers saw the same thing in the same eclipse. No account whatever can be given of the reason of this remarkable appearance.

SUN-BIRDS. *Soui-mangas*,* *Cinnyridæ*, a family of birds of brilliant plumage, living upon the juices of flowers, and representing in the Old World the TROCHILIDÆ, or *Humming-Birds* of the New Continent and its islands.

Cuvier, in defining his genus *Cinnyris*, states that the species composing it have the tail no longer worn; the bill long and very slender, with the edge of the two mandibles finely serrated; and the tongue, which can be protruded from the bill, terminating in a fork. They are, he observes, small birds, the plumage of whose males glitters in the season of love with metallic colours, approaching in splendour that of the humming-birds, which they represent in this respect in the Old Continent, where they are found principally in Africa and the Indian Archipelago. They live, he adds, on flowers, from which they pump the juices: their nature is gay, and their song agreeable. Their beauty makes them much sought after in our cabinets; but as the plumage of the females and that of the males during the interval between the seasons of love is entirely different from its nuptial brilliancy, it is difficult to characterise the species. (*Règne Animal.*)

Cinnyris, in Cuvier's arrangement, stands between *Melithreptus* and *Arachnothera.*

Mr. Vigors considers the *Tenuirostres*, or *Suctorial* birds, the most interesting group, perhaps, of the animal world. 'Deriving,' says that author, 'their subsistence for the most part from the nectar of flowers, we never fail to associate them in idea with that more beautiful and perfect part of the vegetable creation, with which, in their delicacy and fragility of form, their variety and brilliancy of hues, not less than by their extracting their nourishment from vegetable juices, they appear to have so many relations. As the tribe is confined exclusively to the torrid zone and the southern hemisphere, the naturalists of our northern latitudes have little opportunity of observing their manners or of inspecting their internal construction. Much confusion has consequently arisen in assigning them their respective stations, more particularly among the *Honeysuckers* of New Holland, which have been indiscriminately scattered among every group of the order. In the absence of that certain and perfect information which alone can authorise us to decide upon the station of any bird in nature, I cannot, at present, undertake to fill up the details of this tribe with much pretension to accuracy. The following sketch however of the Suctorial families will, I imagine, be found to afford some approach, in its general outline, to the natural divisions into which the tribe branches out, and to the order in which they succeed each other:—*Nectariniadæ ? Cinnyridæ, Trochilidæ, Promeropidæ, Meliphagidæ.* Arranged according to their typical characters, they thus succeed each other:—

Normal Group.

Bills and feet comparatively slender (gracilioribus) . . { *Cinnyridæ.* *Trochilidæ.*

Aberrant Group.

Bills and feet comparatively strong (fortioribus) . . . { *Promeropidæ ?* *Meliphagidæ ?* *Nectariniadæ ?*'

Mr. Vigors then proceeds to state that Illiger was the first who separated the true *Certhia* of the present day from the groups of the Linnean *Certhia*, which feed upon vegetable juices, and which he therefore distinguished by the generic name of *Nectarinia*. This latter genus, observes Mr. Vigors, comprising two distinct and strongly marked groups, has again been separated by Cuvier into two divisions: for the first of which, consisting of birds whose bills are shorter and stronger than those of the second, and whose feet are also in general more robust, he has retained the name of *Nectarinia;* while he has distinguished the latter division, where the bills are longer and more attenuated, and the legs and feet are proportionally more delicate, by the appellation of *Cinnyris*. The two first families in the arrangement of Mr. Vigors accord with these views; and he remarks that, besides the difference in their structure, the two groups may be separated by their geographical limits. The *Nectariniadæ*, as far as Mr. Vigors can trace out their extent, are confined to the New World; while the *Cinnyridæ* are circumscribed within the bounds of the antient continent and its adjoining islands. In looking to the succession of affinities in the tribe, Mr. Vigors remarks that the *Nectariniadæ* appear to hold, by the comparative strength of their feet and bill, an intermediate rank between the *Creepers* and the typical groups of the present tribe. The *Certhiadæ*, as we have seen [CREEPER], employ, he observes, the feet in climbing; the *Nectariniadæ* hop from flower to flower, seeking the nectar of each; while the *Cinnyridæ* and *Trochilidæ* make no use whatever of the foot as they extract their food, but during the process of feeding are poised entirely on the wing. The two last-mentioned families, he adds, again approach each other in the slenderness of their bill, the vividness and changeable lustre of their plumage, and the habit of hovering on the wing when they feed. They are chiefly separated by the comparatively stronger foot and bill of the *Cinnyridæ;* but the geographical distribution of the two families points out a line of demarcation. Mr. Vigors concludes this part of his observations by acknowledging that these two typical families are the only groups in the tribe of whose situation he can speak with any confidence; and these two families form the subject of this article. (*Natural Affinities that Connect the Orders and Families of Birds*, in *Linn. Trans.*, vol. xiv.)

Mr. Swainson considers the *Cinnyridæ*, or *Sun-birds*, so called by the natives of Asia in allusion to their splendid and shining plumage, the subtypical family of the *Tenuirostres*. He observes that the affinity is obvious between this family and the MELIPHAGIDÆ; but whether the direct passage is made by the short-billed honeysuckers (*Dicæum*, Cuv.) or by the spider-suckers (*Arachnothera*, Temm.) is uncertain. 'The plumage of the meliphagous birds of New Holland,' says Mr. Swainson, 'is almost universally dull, or at least destitute of those gay and beautiful tints which are so strikingly developed in the sun-birds: a rich golden-green, varied on the under parts with steel-blue, purple, bright orange, or vivid crimson, decorates nearly all the species, and produces a brilliancy of colours only rivalled by those of the humming-birds. The bill is very long, slender, and acutely pointed, the margins being dentated in the most regular and delicate manner: yet these teeth are so small as scarcely to be seen by the naked eye; the tongue is formed into a bifid tube, or rather, as we suspect, into two flattened filaments; thus differing materially from that of the honey-suckers, which always ends in a brush: the bill also is never notched. The difference between the two structures is softened down by the intervention of the nectar-birds (*Nectarinia*, Ill.), whose bill shows a union of both characters, the margins, being finely dentated, and the tip distinctly notched. The species of the latter are few; and

* Cuvier states that *Soui-mangal* signifies, it is said, in the 'jargon' of Madagascar, *sugar-eater*

while *Cinnyris* is restricted to the tropics of the Old World, *Nectarinia* represents them in the New. Some few other forms, found in Australia and in the Oceanic Islands, belong to this group, and they are arranged in the genera *Melithreptes* and *Dicæum*, but their habits are imperfectly understood.'

The genera arranged by Mr. Swainson under the family *Cinnyridæ* are *Melithreptes*, *Cinnyris*, *Anthreptes*, *Nectarinia*, and *Dicæum*. The family stands between the *Meliphagidæ* and the *Trochilidæ*. (*Classification of Birds*.)

Mr. G. R. Gray makes the *Nectarinidæ*, as he writes the word, the second family of the tribe *Tenuirostres*, placing it between the *Upupidæ* and the *Trochilidæ*.

The *Nectarinidæ* in his arrangement comprise the following subfamilies and genera:—

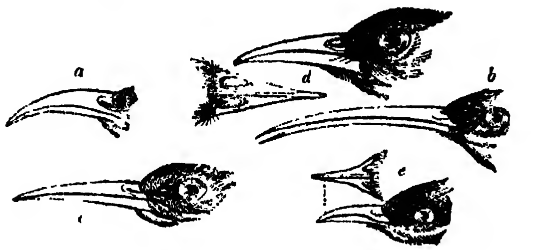
Subfam. 1. *Nectarininæ*.

Genera:—*Moho*, Less. (*Merops*, *Certhia*, Gm.; *Gracula*, Merr.; *Meliphaga*, Temm.). *Drepanis*, Temm. (*Certhia*, Gm.; *Melithreptus*, Vieill.; *Vestiaria*, Flem.). *Arachnothera*, Temm. (*Cinnyris*, Horsf.; *Certhia*, Lath.). *Nectarinia*, Ill. (*Certhia*, Linn.; *Mellisuga*, Vieill.; *Cinnyris*, Cuv.; *Rhyndace*, Mœhr.). *Ptiloturus*, Sw. (*Promerops*, Less.; *Upupa*, Gm.). *Anthreptes*, Sw. (*Mellisuga*, Vieill.; *Cinnyris*, Sw.). *Certhionyx*, Less. (*Certhia*, Cuv.). *Dicæum*, Cuv. (*Certhia*, Gm.)

Subfam. 2. *Cærebinæ*.

Certhiola, Sundev. (*Furnarius*, Steph.; *Nectarinia* (Ill.), Less.; *Certhia*, Linn.). *Dacnis*, Cuv. (*Certhia*, Linn.). *Uncirostrum*, Lafr. and D'Orb.

Upon the whole we take the arrangement of Mr. Swainson. The following cut is after his figures in the *Classification of Birds*.



Bills of Cinnyridæ.

a. Melithreptes. b. Cinnyris. c. Anthreptes. d. Nectarinia. e. Dicæum.

Family Character of Cinnyridæ.—Wings with the outermost quills more or less shortened or graduated. Bill more or less curved, generally entire. Nostrils short, oval, membranaceous, opening by a lateral slit. Feet moderate. Bill entire. (Sw.)

Genera.

Melithreptes, Vieill. Bill long, sickle-shaped; the sides considerably compressed; the culmen elevated, and the tips entire. Nostrils very short, opening by a semicircular slit. Tongue long; the tip only terminated by a bunch of short filaments. Wings moderate; the three first quills nearly equal. Feet robust, long. Lateral toes equal. Tarsus almost twice as long as the hind toe. Pacific Islands. (Sw.)

Example, *Melithreptes Pacifica*.

Cinnyris, Cuv. Bill long, slender; the tips very acute and entire; the margins minutely denticulated; base of the upper mandible folding over, and partly concealing that of the lower. Nostrils short, oval. Tongue retractile, simply forked. First quill spurious, second shorter than the third. Tail even or rounded. India and Africa. (Sw.)

Example, *Cinnyris chalybeia*.

Description.—Golden green, with brown wings and tail, and narrow pectoral red band bordered above by another of steel blue; upper tail-covers blue.

This, according to Mr. Swainson, is *Certhia chalybeia*, Lin., Gmel., *Le Soui-manga à collier*, Vieill., and *Collared creeper*, Lath.

Mr. Swainson remarks that another bird very nearly resembling this has been figured by Le Vaillant under the name of *Le Sucrier à plastron rouge* ('Ois. d'Afr.,' pl. 300), but that Le Vaillant's reasons for separating them are, he thinks, sufficient, at least until more forcible ones are adduced than mere conjecture.

Anthreptes, Sw. Bill moderate, rather strong, slightly curved; widening towards the base, which is much broader than it is high. Base of the under mandible thickened, and not partially covered by the upper. Wings, feet, and tail as in *Cinnyris*. (Sw.)

Example, *Anthreptes Javanica*; *Nectarinia Javanica*, Horsf.

Description.—Glossy metallic purple above, olive yellow beneath; scapulars, rump, and rather broad lateral stripe extending from the corner of the bill to the breast with a slight curvature, glossy violet; the throat chestnut; tail black.

Mr. Swainson describes this bird as a *Cinnyris* in the 'Zoological Illustrations,' and by the name here adopted in his 'Classification of Birds.' These changes however leave his declaration that it is not a *Nectarinia* (a genus confined to the New World) untouched.

Anthreptes Javanica. (Sw., *Zool. Ill.*)

Cinnyris chalybeia, Lesser Collared Creeper. (Sw., *Zool. Ill.*)

Nectarinia, Ill. Bill in general shorter than the head, wide at the base, compressed from the nostrils. Tip of the upper mandible with a distinct notch; the margins entire. Wings long; the three first quills nearly equal. Lateral toes unequal. South America only. (Sw.)

Example, *Nectarinia cyanocephala*.

Description.—(Male.)—Changeable blue; throat, back, tail, and wings black; the quills edged with blue.—Female green; head, cheeks, and scapulas bluish; throat grey. (Sw.)

This, according to Mr. Swainson, is (Male) *Motacilla Cayana*, Linn., Gmel.; *Sylvia Cayana*, Lath.; *Pepit bleu de Cayenne?* Briss.; *Cayenne Warbler*, Lath.; and *Sylvia Cayenensis cœrulea*, Briss. (Female) *Motacilla cyanocephala*, Gmel.; *Sylvia cyanocephala*, Gmel.; *Sylvia viridis*, and *Le Pepit verd*, Briss.; *Blue-headed Warbler*, and *Blue-headed Creeper?* Lath.

Mr. Swainson states that the habits of this bird are per-

fectly the same as those of the rest of the *Nectariniæ*. 'It is,' he says, 'one of the commonest birds of Brazil, and appears spread over the whole extent of that country. It frequents the same trees as the humming-birds, hopping from flower to flower, and extracting the nectar from each; but this is not done on the wing, because its formation is obviously different from the humming-birds, which, on the contrary, poise themselves in the air during feeding.' This is the passage alluded to and quoted by Mr. Vigors (see p. 284).

Mr. Swainson remarks that the young males, as usual before moulting, have the colours of the female, and that the rich sky-blue of the male, in some lights, becomes greenish, and in others dark-blue.

Nectarinia cyanocephala. (Sw., *Zool. Ill.*)
Upper figure, female; lower, male.

Dicæum, Cuv. Bill short, remarkably broad at the base, and suddenly compressed beyond; the tips entire; the margins minutely denticulated; nostrils triangular. Wings, feet, and tail as in *Nectarinia*. Indian and Australian Islands. (Sw.)

The figure referred to by Cuvier gives an incorrect notion of this genus [Creeper], and there must be some mistake; but the reader will find a most elegant and characteristic drawing of *Dicæum hirundinaceum* in Mr. Gould's grand work of the 'Birds of Australia.'

Mr. Gould states that the *Swallow Dicæum* has neither the habits of the Pardalotes nor of the Honey-eaters: it differs, he says, from the former in its quick, darting flight, and from the latter in its less prying, clinging, and creeping actions among the leaves, &c. 'When perched on a branch,' continues Mr. Gould, 'it sits more upright, and is more swallow-like in its contour than either of the forms alluded to: the structure of its nest and the mode of its nidification are also very dissimilar. Its song is a very animated and long-continued strain, but is uttered so inwardly that it is almost necessary to stand beneath the tree upon which the bird is perched before its notes can be heard. Its beautiful purse-like nest is composed of the white cotton-like substance found in the seed-vessels of many plants; and, among other trees, is sometimes appended on a small branch of a *Casuarina* or an *Acacia pendula*. It was on the latter tree that I found a nest containing three or four young: a second nest, with the eggs, was given to me in Sydney. The ground-colour of the eggs is dull white, with very minute spots of brown scattered over the surface: they are nine lines long, by five and a half lines broad. The *Male* has the head, all the upper surface, wings, and tail black; throat, breast, and under tail-coverts scarlet; flanks dusky; abdomen white, with a broad patch of black down the centre; irides dark-brown; bill blackish-brown; feet dark-brown. The *Female* is dull-black above, glossed with steel-blue on the wings and tail; throat and centre of the abdomen buff; flanks light-brown; under tail-coverts a pale scarlet.'

Locality.—The Australian continent, generally.

SUN-FISH, a fish so named on account of its almost circular form and shining surface. This most remarkable fish belongs to the family *Gymnodontidæ*, and genus *Orthagoriscus*. As in others of the family, the sun-fishes have the jaws provided with an ivory-like substance, divided internally into laminæ, which represent the teeth, those being united as it were into a solid mass. The opercula are small, and the branchiostegous rays are five in number; the body is compressed; the pectoral fins are of moderate size; the dorsal and anal fins, both of which are long, are united with the caudal, and thus surround the hinder portion of the fish, which appears as if it had been truncated. The short sun-fish (*Orthagoriscus mola*, Schneider) has been found on various parts of the British coast; when however observed in our seas, they have generally, Mr. Yarrell remarks, appeared as though dead or dying, and floating along on the side, presenting the broad surface of the body to view. 'Dr. Neill says, of one that was brought to him, the fishermen informed him that, when they observed it, it was swimming along sideways, with its back fin frequently above water. It seemed to be a stupid, dull fish: it made little or no attempt to escape, but allowed one of the sailors to put his hands under it and lift it fairly into the boat. The sun-fish has been generally mentioned as remarkable for its phosphorescence, but this specimen did not exhibit that phenomenon so distinctly as a haddock or a herring.'

This fish is said to feed on sea-weeds: its body, viewed sideways, presents nearly a circular figure; the jaws are slightly produced; the eye is rather small, and the pectoral fin is small and rounded. Occasionally this species attains the length of four feet, and weight of upwards of three hundred pounds: the skin is very rough, and chiefly of a silvery colour.

The oblong sun-fish (*Orthagoriscus oblongus*, Schneider), usually found at the Cape of Good Hope, is said also to have occurred on the British coast. Dr. Turton describes the body of the oblong sun-fish as being nearly three times as long as it is deep.

A third species of the present genus, of small size, is sometimes met with in the Atlantic: it is the *Orthagoriscus spinosus* of Bloch.

SUN-FLOWER, the English name of a genus of plants called Helianthus, from ἥλιος, the sun, and ἄνθος, a flower. Two reasons have been assigned for giving the plants of this genus this name: first, the resemblance of the large disk and ray of their flowers to the sun; and second, the tendency of these flowers, in a stronger degree than in other plants, to present their face to the sun. From this circumstance the French *tournesol*, Italian *girasole*, and English *turnsol* have been given. This is a genus consisting of very stately herbaceous plants, and containing upwards of forty species, all of which are indigenous to America. It belongs to the natural order Compositæ, and has the following characters: head composed of many flowers, the flowers of the ray being ligulate and neuter, the flowers of the disk tubular and hermaphrodite; involucre irregularly imbricated, the outer scales foliaceous, the inner ones scaly; receptacle plane or convex, covered with oblong acute scales; tube of the corolla of discoid flowers short, 5-toothed; style appendiculated; fruit an achenium compressed laterally; pappus in the form of two lanceolate acute deciduous scales. The leaves are opposite, sometimes superiorly alternate, and either entire or toothed. The whole plant is scabrous or villous. The flowers are solitary, and of a yellow or orange colour.

H. annuus, annual sun-flower, is an herbaceous annual plant with thick rough stems from 6 to 20 feet in height; leaves alternate, petiolate, nearly heart-shaped, crenulated or dentated, rough; the heads are large, from one to two feet in diameter, and composed of a multitude of flowers of a beautiful yellow colour, terminal, solitary, inclined, the disk vertical and oftenest facing the south. This species is the largest of the genus: it is indigenous in Mexico and Peru; it was

early introduced into Europe after the discovery of America, and has since been very generally cultivated in gardens, on account of its very large and handsome yellow flowers. The plant however in Europe never attains the height nor the flowers the size they do in their native soil and climate. The albumen of the seeds of this plant contains a large quantity of oil: and it has been proposed to cultivate it for the sake of obtaining this oil, which is very palatable, and might be used for the table. For this purpose the Society of Arts some years ago offered a prize for the raising a quantity of the seed: some experiments were made, but they do not appear to have been followed up in this country. In France it has been cultivated in fields to some extent, and from the variety of uses to which the plant may be applied, it would seem to deserve further attention. The quantity of oil to be obtained from the seeds varies: they do not produce so much in this country as in the south of France, nor so much there as in Spain and America. M. Henry found that 25 pounds of the achenia, when deprived of their pericarps, gave 8 pounds of albumen, which yielded by expression, cold, 13 ounces of a citron-coloured oil, and the same quantity hot yielded 19 ounces of oil slightly acid. In Spain the seeds are said to produce half their weight of oil. (Pouchet, *Traité de Botanique*, tom. ii., p. 193.) The fruit of this plant has been strongly recommended for feeding various kinds of domestic animals. Cows and oxen, horses, sheep, pigs, rabbits, and poultry are all fond of it. For this purpose the fruit should be reduced to the state of meal, and can either be given dry or made into a cake. The cake also that is left after expressing the oil may be used for feeding animals. Small cage-birds, as canaries, finches, &c., are very fond of the seeds. When torrified in the same manner as the seeds of coffee, they make an agreeable drink, which may be used as a substitute for that article. The liber of the bark of the stem is composed of a very tough woody tissue, which may be manufactured into twine and cordage, and a very good paper may also be made from the same tissue. The pith of this plant is almost entirely composed of the vegetable principle called *medullin*, and has been used in Russia for the manufacture of moxas for medical purposes. All parts of the plant contain a considerable quantity of nitre, and on this account when dried they form an excellent material for fuel. In the garden it is a handsome ornament, opening its large heads of flowers in July and August, which are then a favourite resort of bees.

H. multiflorus (many-flowered sun-flower) is not so high a plant as the last, nor are its flowers so large. It has vivacious roots, which produce numerous herbaceous stems, which are branched and rough; its leaves are alternate, petiolate, dentated, the inferior ones are heart-shaped, the superior oval and acuminate; the heads of flowers are numerous and not inclined. It is a native of Virginia. A variety of this species is common in gardens, and is called double, but the apparent doubleness consists in the corollas of the disk, which are usually tubular, becoming ligulate. It continues in flower longer than the last, and is much cultivated in Paris, where, in the autumn, it is the pride and glory of the parterre. It is easily propagated by dividing its roots in the spring or autumn.

H. tuberosus (the tuberous sun-flower, or Jerusalem artichoke). This latter name is a barbarous corruption of the Italian *Girasole*, this species having been introduced into Europe at the Farnese garden at Rome, from whence it was originally distributed. The roots are composed of a number of oblong tubercles, very large and fleshy, reddish outside and white within, resembling a potato; the stems are herbaceous and upright; the leaves are alternate and opposite, petiolate, oval, rough; the heads of flowers are yellow and small compared with the two preceding species. It is a native of Brazil. In France it is also known by the name of *Topinambour* and *Poire de terre*. According to Braconnot and Payen, the tubers do not contain fecula, but a vegetable principle called *Inuline* or *Dahline*. These tubers when cooked form a good substitute for potatoes, and by some are even preferred. Many animals eat them with avidity, and they are especially recommended for sheep. Payen has succeeded in obtaining from them by fermentation a liquor resembling beer, which might be used as a substitute for that beverage. This species is not easily produced from seed in this country, but it may be propagated by its roots, which will produce stems for many years if allowed to remain in the same place. It will grow in almost any soil, but the better the soil is the more vigorous and productive will be its growth.

Some of the species secrete a resinous juice, which is found to exude from the various organs of the plant. This is most observable in the *H. thurifer*, in which the resinous matter runs down the stem. This is sometimes observed to occur in the flowers of *H. annuus*. The *H. indicus* of Linnæus and our gardens is probably only a variety of *H. annuus*, and is not a native of India, as its name would imply. This last species, according to Dr. Royle, is cultivated by the natives of India for the purpose of obtaining oil from its seeds.

SUNDA ISLANDS is a term of unknown origin, but generally applied to the western and larger portion of the Indian Archipelago. The sea which lies between the island of Java on the south and that of Borneo on the north was formerly generally known by the name of the Sunda Sea, but at present it is very frequently called the Java Sea. Properly speaking, only the islands which enclose that sea were called the Sunda Islands, and then the term was only applied to the large islands of Java and Borneo, which lie south and north of it, and to those of Sumatra and Celebes, which enclose it on the west and east. These four islands are still generally called the Greater Sunda Islands; but as there was no general name for that chain of islands which extend from the eastern extremity of Java to the coast of New Guinea or Papua, the name of Sunda Islands was extended to them by geographers, and they go now under the general name of the Lesser Sunda Islands; so that under the term Sunda Islands the whole of the Indian Archipelago is comprehended, with the exception of the Moluccas, the Sooloo Archipelago, and the Philippines. The greater Sunda Islands [BORNEO, CELEBES, JAVA, and SUMATRA], with their dependencies [BANCA, BILLETON, and MADURA], are noticed under separate heads.

SUNDA ISLANDS, LESSER, are situated between 5° and 11° S. lat., and between 114° and 135° E. long. Although these islands were early visited by the Portuguese, who formed small settlements on some of them, and although the Dutch East India Company afterwards kept a small establishment on many of them, they were almost entirely unknown in Europe until lately. The Dutch Company had no other object in occupying them than the destruction of the cloves and nutmeg-trees for the purpose of appropriating to themselves the exclusive commerce in the produce of these trees; and accordingly they prevented other Europeans from approaching these islands, and withheld all information respecting them. But since the abolition of the company, the Dutch government has taken into its own hands the government of its possessions in the East Indies, and some accounts of these islands have been published in Holland. Some of them have also been recently visited by whaling-vessels, and since the formation of a British colony on the north coast of Australia an active intercourse has been established between Port Essington and the eastern groups of the Lesser Sunda Islands; and it is probable that these islands will acquire a greater value in the eyes of Europeans, and in a short time we shall become better acquainted with them.

The Lesser Sunda Islands consist of four large groups, which, from west to east, are called the Timor Islands, the Serawatte Islands, the Tenimber group, and the Aroo Islands. The term Lesser Sunda Islands is frequently applied to the Timor Islands alone.

The *Timor group*, so called from the largest of the islands, extends from 114° to 127° 30′ E. long., and comprehends the greater part of the islands and the larger islands of the whole chain. Between 114° and 119° it consists of three large islands, Bally, Lombok, and Sumbawa, which lie west and east of one another. But between 119° and 127° the islands constitute a double row, of which the northern, lying between 8° and 9° S. lat., comprehends Comodo, Flores, Solor and Adinara, Lombten, Pantar, Ombay, and Wetter. The southern row forms a curve towards the south, advances nearly to 11° S. lat., and consists of the islands of Sumba or Sandalwood, Savu, Rotti, Simao, and Timor. The straits which separate these islands from one another are often navigated by vessels bound to or from China, when they reach these seas in seasons during which the navigation through Sunda Strait is either dangerous or tedious.

Lombock Strait, which separates Bally from Lombock, is more than 40 miles long, and at the southern extremity it

is divided into two channels by an island called Banditti Island. At this part it is about 30 miles wide, but towards its northern extremity it narrows to about 12 miles. It is rarely navigated by vessels coming from the north, as a strong current generally sets through the strait from the south, and there are no soundings in the middle of it. But as there are a few anchorage-places on each side of the strait where the current is weak, it is frequently used by vessels from the south.

The *Strait of Allas*, which extends between Lombock on the west and Sumbawa on the east, is more than 50 miles long, and about 12 miles wide on an average, but it narrows in some places to 7 miles. This strait is more used by vessels going to or returning from China through the seas lying east of Borneo, than any other of the straits between the Lesser Sunda Islands, because the current is very moderate, never exceeding two knots per hour, and though there are no soundings in the middle of the strait, anchorage is generally found along the shores of the island of Lombock.

The island of *Sumbawa* extends from west to east about 180 miles, but its width varies between 50 and 20 miles; two large bays, Sallee and Bima bays, enter deeply into the island from the north. The average width may be 40 miles, which gives an area of 7200 miles, or about 800 miles less than that of Wales. Along the southern shores of this large island extends a mountain-range, which begins on the shores of the Strait of Allas and terminates on those of Sapy Strait. Seen from the sea, this chain seems to consist of two parallel ridges, rising one above the other to a great elevation. About the middle of this chain, and opposite the Bay of Sallee, which cuts it nearly in two, is a deep depression in the range, which is not much above the sea-level, and is covered with thick forests. The shores of this mountain-tract are high and steep. It is not known how much of the island is covered by these mountains. The remainder of the island is generally hilly, but a few of the elevations rise considerably above the rest. The most remarkable of them is Tumbora Peak, a volcano, whose eruption in 1815 is one of the most terrible on record: the island suffered dreadfully; whole towns and villages were destroyed by the ashes, of which a vast mass was thrown out, and which were carried as far as Surabbaya in Java, and to the islands of Macassar and Amboyna. Its elevation above the sea, according to different estimates, is between 6000 and 9000 feet. The low and level tracts occupy only a comparatively small part of the island, and they generally occur at the innermost recesses of the bays along the northern coast, and along the Strait of Sapy. The Strait of Allas presents a high and rocky coast, which however towards the north is lined by many low rocky islands, between which and the main body of Sumbawa the sea is deep enough for vessels of considerable size, but it is not much navigated, owing to its rocky bottom. The soil of this island seems to be much inferior to that of Lombock or Balli, but it does not differ in vegetable productions, except that in the forests, which cover a considerable part of its surface, there is a great number of teak-trees. In the vicinity of the sea however there are no large trees, which is owing to the great consumption for ship-building. The animals are also the same as in Balli, but buffaloes are very numerous, which are rather scarce in Balli. The horses of this island, especially those of Bima, are the finest breed in the whole Archipelago, and are extensively exported. These ponies—for they are never more than thirteen hands high—possess strength, symmetry, and beauty, and bear some resemblance to the Arabic breed. Sumbawa seems to have minerals; at least gold is collected in some of the small rivers. Pearls are found in Sallee Bay. The island is divided into six petty states, Bima, Sangar, Tumbora, Papekat, Sumbawa, and Dimpo, which are independent of each other, but united together by a defensive alliance. The Dutch have established a kind of authority in the eastern districts; but the western states, Sumbawa and Dimpo, are quite independent. Very little is known of the commerce of this country, except that some intercourse exists between Bima and Java, and that the trading boats from Ceram and Celebes visit the port of Sumbawa. These seem to be the only places from which the produce of the island is exported.

To the east of Sumbawa is the *Strait of Sapy*, which on the other side is formed by the island of Comodo. This strait is about 40 miles long, and towards the southern entrance, where the narrowest part of it occurs, about 12 miles wide. It is considered safe for ships, and was formerly much frequented, but it is not so convenient as Allas Strait, for the tides are rapid in the narrow part, where some rocky islands separate the strait into several small channels. There is however good anchorage in Sapy Bay, on the island of Sumbawa. The northern part is divided into two channels by the island of Gilibanta, which is of considerable size, and has a peak near the centre. Near the northern entrance of Sapy Strait is the island of Goonong Apee, which is very high, and formed of a large mountain with two summits, of which the south-eastern is called the Lawa Peak, and is a volcano. The island of Comodo consists of a high rocky mass covered with wood, and is not further known. On the east of it is the *Strait of Mangerye*, which is not frequented on account of the numerous rocky islands with which it is studded, and which render the navigation intricate and dangerous.

East of this strait is the island of Flores, so called by the Portuguese. [FLORES.]

East of the Strait of Flores are five islands of considerable extent: Sebrao and Solor, already mentioned; and Lomblen, Pantar, and Ombay, each comprehending an area of from 300 to 400 square miles. All of these are very high and bold, especially the three last mentioned. A peak on Lomblen is visible at the distance of 50 miles. On Pantar are three summits, the highest of which is an active volcano. The inhabitants of Sebrao are Christians, and connected with Larantuca and Delli. Solor is dependent on the Dutch of Coopang, and sends to that place large quantities of wax and fish-oil. The wax is obtained from the Haraforas, who inhabit the most elevated part of the island, and the fish-oil from that species of whale which is called blackfish, and which is extremely abundant in the sea between Solor and Sandalwood. It produces oil inferior only to the spermaceti. The inhabitants of the coast are Mohammedans. The inhabitants of Lomblen, Pantar, and Ombay are numerous, and mostly if not entirely belong to the Haraforas: they avoid any communication with foreigners, and these islands are very rarely visited by Europeans, and not frequently by Bugis, who obtain from them large quantities of wax. Whalers sometimes are supplied from them with stock. The straits that divide the islands are not safe, and are very rarely used. Alloo Strait, between Lomblen and Pantar, though without soundings, is frequented by the junks and vessels which sail from Celebes, or from Macao to Timor. It is better than Pantar Strait between Pantar and Ombay, being wider and the land on each side not so high; consequently it is less liable to calms, squalls, and irregular currents of wind and water.

The island of Sandalwood, the native name for which is Sumba, lies south of the Strait of Sapy and of the island of Flores, being divided from the latter by a strait about 36 miles wide. It extends from north-west to south-east about 100 miles, with an average width of 50 miles, which gives a surface exceeding 5000 square miles. This island is not low, as is commonly supposed, but forms a table-land of considerable elevation; most parts of the southern coast of which are visible at the distance of 30 miles. Its surface however is only undulating, except towards the west, where there is a peak, which can be seen at the distance of 60 miles. The inhabitants are Haraforas, but the Dutch had succeeded in forming a commercial establishment there: they were however expelled, because they cut down some sandal-wood trees, as the inhabitants have the belief that for every tree of this kind which is cut down one of the natives loses his life. There is now no other communication between this island and the rest of the world than by the Bugis of Endé in Flores, who go there to obtain large quantities of bees'-wax and birds'-nests. The coast of this island is generally steep and without soundings. Anchorage is found only on the north-east coast in Padewawy or Baring's Bay.

Between Sandalwood and Timor are the islands of Sáwu and Rotti. Sawu is about 20 miles long from south-west to north-east, and on an average 10 miles wide: its area is 200 square miles, or equal to Rutlandshire. It is hilly throughout, and has a stony soil, but in good seasons it is tolerably fertile. The supply of water is very scanty. The cultivation of the ground is much neglected: it produces only small quantities of maize, millet, kachang, and sweet potatoes, and sufficient cotton for home consumption. In dry seasons, when the crops fail, the inhabitants derive sub-

sistence from the sugar of the lontar-trees (*Borassus flabelliformis*). This sugar is also the only article of export, and is carried off by the Bugis. Their domestic animals are those of the other islands. The wild animals are hogs and deer, but they are not numerous. The inhabitants, about 5000 in number, have frizzled hair, and resemble those of Timor. They are governed by four chiefs, who acknowledge the supremacy of the Dutch, who have an interpreter here. The only advantage which the Dutch derive from this island is men for soldiers.

Rotti extends from south-west to north-east about 60 miles, with an average width of 20 miles: its area is about 1200 square miles, or equal to that of Staffordshire. The surface is a succession of low hills and narrow valleys; the soil is very stony, but productive. The rivers are few and small, and the supply of water generally scanty. Rice in quantity, with Indian corn, millet, sweet potatoes, and kachang are cultivated, but the crops are only equal to the consumption of the inhabitants. In dry seasons they depend on the sugar of the lontar-trees. Cotton is grown, but not enough for consumption; some is imported from Celebes. The horses, or rather ponies, are better than those of Timor, but not equal to those of Sumbawa. The population is stated to exceed 50,000, or about 42 to a square mile. The inhabitants have long lank hair, whilst nearly the whole of the inhabitants of the surrounding islands have frizzled hair. Their features are also much more prominent, and they bear a stronger resemblance to the natives of Hindustan than to those of the Indian Archipelago. The language, though many words are the same as in the Timorese, presents such material differences that at present the natives of the two islands do not understand each other. They are governed by eighteen chiefs, who acknowledge the supremacy of the Dutch, and an interpreter is stationed on the island. Some f the chiefs profess Christianity, but the majority are pagans. The trade is almost entirely confined to the exchange of palm sugar with the Bugis for cotton; of horses and buffaloes with the whalers and other ships for muskets and ammunition; and of their bees'-wax with the inhabitants of Coopang for such small articles of European, China, and India manufacture as they require. This last trade amounts annually to 4000 Spanish dollars. As the inhabitants are good soldiers, the Dutch employ them frequently in their wars with the natives of Timor.

The island of *Timor* is the largest of the Lesser Sunda Islands, being 300 miles long from south-west to north-east, and on an average 45 miles wide. This gives an area of 13,500 square miles, or half the extent of Ireland. A chain of mountains runs through the middle of the island from one extremity to the other, and some of the summits attain such an elevation that Flinders compares them with the mountains of Teneriffe. Along the southern coast the land fronting the sea is generally low or slightly elevated, but at a short distance there are hills which rise in gentle declivities towards the mountains. On the northern coast the land is uniformly high at a short distance inland, sloping down in many parts towards the sea. Though the greater part of the island consists of a succession of narrow valleys, and hills or mountains with steep sides, there are a few large plains, of which one of the largest is at the bottom of Coopang Bay, which is more than ten miles square. All the rivers are small, and descend so rapid a declivity, that none of them are navigable beyond the tidal point; though the tide is nine feet at the full and change, it seldom ascends above 400 yards from the mouths of the rivers, and only in one of them as much as two miles. The soil in many places is fertile, but the greater part of the interior has not been visited by Europeans. In the plain of Bow-Bow, near Coopang, the average crop of rice is upwards of seventy fold. The principal objects of agriculture are rice, maize, millet, pulse, sweet potatoes, and cotton. Rice is in general not much cultivated, owing to the hilly nature of the country. Maize is the principal article of food, but the produce is not equal to the consumption, for except in very plentiful seasons the inhabitants depend for subsistence during a part of the year on the sugar of the lontar-palm. In some parts of the island a species of sago-palm is found, and used as food. Small quantities of sugar-cane are raised, but not for the purpose of making sugar. Cocoa-nut and areca-palms are very scarce, but different kinds of fruit-trees common to these islands abound, as oranges, jack-fruit, &c. The domestic animals are horses, buffaloes, sheep, goats, dogs, and cats. The wild animals are buffaloes, deer, hogs, a species of large wild-cat, and one kind of monkey, all which are eaten by the natives, except the monkeys and cats. Gold is found in several of the rivers, both in lumps and in small particles, and some of the lumps weigh two ounces. But superstitious motives prevent the natives from collecting it. Native copper is said to abound in the Philaran Mountains, which are situated near the centre of the north-west side of the island. The natives are of a very dark colour, with frizzled bushy hair, but they resemble the Papuas less than the natives of Endé. They are below the middle size, and rather slight in figure. In the form of their face they resemble the South-Sea Islanders rather than any of the Malay tribes. Human sacrifices are made on certain occasions, but in the vicinity of Coopang they have been put down by the authority of the Dutch governor. The island is divided among many petty chiefs. It is supposed that they are either dependent on the Dutch or on the Portuguese. The whole southern coast is considered to belong to the Dutch, but as there are no harbours the Dutch have formed no establishments, and their authority is only nominal. The eastern part of the north coast, as far west as Batoo-Gedé, is under the authority of the Portuguese, but west of that place the possessions of the two nations are completely mixed.

Coopang is situated near the western extremity of the island, and is a large bay, about 12 miles wide at the mouth, and upwards of 20 miles deep. It is formed by the island of Semao on the south-west and a projecting point of Timor on the north, and has excellent anchorage. In the easterly monsoon it is a safe harbour, but as it is open to the north-west, ships cannot lie there when the monsoon blows from that quarter. Then however they find shelter either under a small island called Pulo Tekoos, on the north side of the bay, or in the strait which divides the island of Semao from the main body of Timor. Fort Concordia, the principal settlement of the Dutch, is situated on the south side of the bay. The trade of this place is considerable, and is said to amount annually to rather more than 1,200,000 Spanish dollars. The principal articles of export are wax, sandal-wood, earth-oil, and cattle. The cattle go chiefly to the islands of Mauritius and of Amboyna. The imports are coarse blue and white cotton-cloth, large-pattern chintzes and handkerchiefs, China silks, China ware, China umbrellas, muskets, gunpowder, iron, coarse British cutlery, and lead. The Chinese and the Bugis visit this place.

The Portuguese have three settlements on the northern coast, Batoo-Gede, Dilli, and Manatatoo. Dilli is the principal settlement: the harbour is open to all winds from west-north-west to east-north-east, but is perfectly defended from the swell of the sea by a reef of rocks (dry in some parts at low-water), which extends across it, leaving only a narrow passage at the north-west end, by which large ships enter the harbour. The town is rather populous, but meanly built, and the small houses of which it consists are scattered over a large tract. The commerce of this place seems not to be inferior to that of Coopang. The principal articles of export are slaves, wax, sandal-wood, benzoin, and ambergris, most of which are exported to Macao, except the slaves, which go to other islands of the Indian Archipelago, especially to Celebes. The imports are the same as at Coopang, with rather a greater proportion of Chinese goods.

To the north of Timor is the island of *Wetter*, which is about 65 miles long, and 20 miles wide on an average. This gives an area of 1300 square miles, or a little more than the extent of Wiltshire. It is a high rocky mass, but much less elevated than Timor. The Dutch had formerly a small establishment on the south coast at Saaw. But at present the inhabitants have no commercial intercourse, except with those of Kisser, who fetch wax, sandal-wood, rice, and maize, and give in return cotton-cloth, linens, and iron. The domestic animals are sheep, hogs, fowls, and buffaloes. The bulk of the population are Haraforas, but on the coast there are some settlers of Malay race.

The *Serawatti* group, situated between 9° and 6° S. lat., and between 127° and 131° E. long., consists of two rows of islands, which extend between Timor and Wetter on the west and Timorlaut on the east. Though the Dutch for nearly two centuries have had some establishments on these islands, they were a few years ago so little known, that even in Hamilton's 'East India Gazetteer' only two of the islands

are named, and none are described. Lately this group has been visited by Kolff, and some British vessels from Essington, which went there for provisions.

The southern series consists, besides several smaller islands, of which the greater number are uninhabited, of seven islands of moderate size, which, from west to east, are Kisser, Lettu, Moa, Lakor, Locan, Sermatte or Serawatti, and Baber or Babá.

Kisser is about 18 miles in circumference, and the surface is hilly; many of the hills have a rugged and irregular appearance. In the valleys, which have a fertile soil, and on the sides of many of the hills, rice is grown, with the sugar-cane, yams, sweet potatoes, tobacco, cotton, and many culinary vegetables, scarcely an available spot being left uncultivated. It contains between 7000 and 8000 inhabitants, more than 1700 of whom are Christians of the Dutch Protestant creed; about 500 of them are descended from the Dutch, who formerly resided on the island. Two dialects are spoken, which differ so much, that individuals are often met with in the island who cannot understand one another. The natives are of the middle size and generally well made; their colour is dark brown; the hair generally straight, but often slightly curled: and the features are by no means so broad as those of the Malays; indeed many might pass for Europeans, if it were not for the darkness of their complexions. The descendants of the Dutch are often as fair as Europeans. Though this island is well provided with domestic animals, as buffaloes, cattle, pigs, sheep, and fowls, a great number of these animals are brought from the other islands, and there exchanged for cotton-cloth, ammunition, glass, coarse cutlery, &c. The island is the resort of traders from Celebes, Amboyna, and Banda, and therefore an emporium for foreign goods, to obtain which it is visited by the natives of the islands to the eastward. The inhabitants have many trading-boats, some of them 40 or 50 tons burden, with which, towards the end of the dry season, they visit the other islands to dispose of their foreign goods for the produce of the country. The goods imported at Kisser are chiefly cottons, iron, earthenware, muskets, gunpowder, spirits, brass-wire, cutlery, and beads; the exports are tortoise-shell, bees'-wax, rice, cotton, native cloths, tobacco, sandal-wood, maize, and live stock of all descriptions. The women manufacture considerable quantities of cloth from the cotton produced on the island, the greater portion of which is disposed of to the people of the neighbouring islands. The yarn is dyed before the cloth is manufactured. The coast of the island is steep and rocky, but there are many small inlets for boats. At the western extremity, and on the south-eastern coast, there is anchorage for larger vessels.

Lettu, which lies farther east, and is larger than Kisser, is surrounded by reefs at the distance of about half a mile. The interior is mountainous, but surrounded by a lower tract, which at a short distance from the shores rises into hills, on which the villages are built. In productions it does not differ from Kisser, but it is much less populous, and not so well cultivated. Many of the inhabitants have been converted to the Protestant creed by the Dutch. *Moa* is perhaps twice as large as Kisser. It has good anchorage on the east side. The surface is level, except that there is a high mountain, called Karban, at its north-eastern end. This peak resembles that of Teneriffe, but is not so high. Cultivation is very limited, the greatest part of the island being used as pasture for buffaloes, cattle, sheep, goats, and pigs. There are no horses on this island, nor on any other east of Timor. Many of the inhabitants have embraced Christianity. Moa is the last island on which the Christian religion has made any progress: most of those who have become Christians have learned to read and write. *Lakor* consists of coral rocks, is low and level, and only covered with a thin layer of earth. It contains no large trees, except cocoa-nut palms, and nearly the whole island is covered with low bushes. There is no fresh water, and the inhabitants use rain-water, which is collected in tanks. Cultivation is very limited; only small quantities of maize, yams, and sweet potatoes are grown. Many hogs and sheep are kept, and also a few buffaloes. The population is small. Kolff found only two Christians among them. *Locan* is surrounded by submarine reefs; there are several small islands on the reefs, which are uninhabited, but cultivated. Locan itself consists of an elevated mountain, which is visible to a great distance, and the island is only inhabited at the north-eastern base of the mountain, where it is covered with extensive plantations of cocoa-nut and sago-trees. Goats and hogs are plentiful, and exported. But the most important productions are trepang and tortoise shells. Locan is the most western of the Lesser Sunda Islands, where that kind of holothuria from which the trepang is obtained is found abundantly and of excellent quality. The trepang-banks are near the reefs which surround the islands. All these articles are exported to Banda, Amboyna, and Celebes, whence several vessels annually visit this island. They give in return for the above-mentioned articles cotton-cloth, cutlery, gongs, and some other Chinese manufactures. *Serawatti*, or, as Kolff calls it, Sermatte, is not visited by Europeans, because no anchorage is found near it. It consists of one mass of rocks, running east and west, and rising abruptly out of the sea. It is said not to be well inhabited: it produces rice, maize, yams, &c., which, with some domestic animals, are brought to Locan for coarse cloth and a few other articles. The most eastern of the southern row of the Serawatti islands is *Babber*, or, as Earl calls it, Babá. It is nearly 30 miles long, with an average width of 10 miles. The surface is mountainous. It has good anchorage at the western extremity, near the village of Tepa. The interior of the island is uninhabited, and also the northern side. All the villages are in the west and south-east districts. As articles of cultivation, maize, yams, and cocoa-nut trees are mentioned. The domestic animals found in the other islands are plentiful here, and in the uncultivated parts there are wild hogs and goats, and many kinds of birds. This island is not much visited. Only once or twice annually a coasting vessel from Banda comes to fetch the produce of the island, especially animals, and brings in exchange coarse cotton-cloth and a few other articles.

The northern series of the Serawatti Islands contains, besides a few smaller islands, four larger islands, Roma, Damma, Nila, and Seroa. The three last mentioned contain active volcanoes, which constitute the connecting link between the volcanoes of the Sunda Islands and those of the Malaccas. *Roma* is about 21 miles in circumference, and has an anchorage on the south and another on the north-west coast. The surface is a succession of hills and valleys. The island is covered with trees, except on the south coast, which alone is inhabited and cultivated. The inhabitants have made more progress in civilization than those of the other islands, except Kisser. Many of them can read and write, and are Christians. The articles of export are wax, sandal-wood, edible birds'-nests, and great quantities of tortoise-shell, as the small neighbouring islands are the resort of numerous turtles. *Damma* is mountainous, but not very high, except the Peak of Damma, near the north-east coast, which always emits smoke: at its base there are hot-springs. It is not very fertile, and the inhabitants live mainly on the produce of their cocoa-nut and sago plantations, cultivating only a little maize, yams, and sweet potatoes. Game is very abundant, especially wild hogs and many kinds of birds. A few of the inhabitants are Christians. *Nila* is a round mass of rocks rising with a steep ascent from a deep sea. There is a volcano on the east side, and on the north side an anchorage for small vessels. Its productions for exportation are hogs, fowls, and cocoa-nuts, which are brought to Banda by the islanders themselves. *Siroa*, called Serra by Kolff, is likewise a mass of volcanic rocks: in 1693 there was a terrible eruption, in which a part of the mountain subsided, and a lake was formed filled with burning matter. The population is small.

The *Tenimber Islands* are situated between 6° 30′ and 8° 20′ S. lat., and 131° and 132° 20′ E. long., and consist of one large island, Timorlaut, and three of moderate size, Cerra, Larrat, and Vordate, and a great number of smaller islands, with which the seas along the north-west coast of Timorlaut are dotted. The channels by which these islands are divided from one another are only wide enough for small prahus: they contain numerous trepang-banks. The larger of the Tenimber Islands have only lately begun to be known. *Timorlaut* extends nearly 90 miles from south to north, and is 40 miles wide in the broadest part. We know nothing of it, except that the surface is rather undulating than hilly, and that it is surrounded either by reefs or by mud-banks, which extend to a considerable distance from the shores and render access impossible for large vessels. The natives are very unfriendly to strangers, and the crews of some European vessels who have been incau-

tions have been killed and the vessels destroyed. *Cerra*, which lies west of Timorlaut, is very populous. The inhabitants are the traders of this group of islands, and export their cattle, which however only seem to be found in Timorlaut, and other domestic animals, and also tortoise-shell and trepang to Banda. *Larrat*, a considerable island, to the north of Timorlaut, resembles it in surface. *Vordate*, north-east of Larrat, contains lofty hills, and is described as very fertile, and rich in all the products of these islands, except cattle. It is very populous. Sago-trees and cocoa-nut trees are abundant.

The inhabitants of the Tenimber Islands differ materially from those of the other groups. They are well made, and their complexion is not so dark. In their features they have so little of the characteristics of the other nations which inhabit the Indian Archipelago, that they, like the inhabitants of Rotti, might be taken for Europeans, if their complexion was lighter. They have also attained a considerable degree of civilization, which may be inferred from their dwellings, which are from 20 to 30 feet long and from 12 to 15 feet wide, and divided into several rooms. They have vessels, about 50 feet long and from 10 to 12 feet wide, which are constructed with great skill, though without any iron. They pay also great attention to the cultivation of the ground.

The most eastern group of the Lesser Sunda Islands are the *Arroo Islands*, which are situated between 5° 20′ and 7° S. lat. and between 34° and 35° E. long. When the account of these islands in vol. ii., p. 397, was printed, our information was not derived from an eye-witness, but since that time the voyages of Kolff have been published, which contain much information respecting them. According to his map, this group consists of one large island, called Kobrore, which is 70 miles long and about 30 miles wide on an average, and two other considerable islands, Tranna and Mykor, which lie west of Kobrore, and are divided from it by a narrow strait. To the north of Kobrore and Mykor are eight or ten islands of moderate size, of which *Wammer*, *Wokan*, and *Wadyier* are the most remarkable. All these islands are moderately elevated, and they have a slightly undulating surface: Kolff thinks that the base of these islands is isolated rocks, and that the intervals between them have been filled up by polypiaria. The channels which divide these islands from one another are narrow, and the tides in them are very irregular. The islands are not rich in productions. Cultivation is limited to the planting of sago trees and the raising of yams. Rice is imported from Banda. Of domestic animals there are only hogs, goats, and fowls. Wild hogs are very numerous. The bird of paradise is found only here and on Papua, and the feathers are an article of export. The principal articles of export however are drawn from the sea, of which trepang is the most important. The trepang-banks are mostly situated to the east and south of the islands, and are very extensive. There is also an export of mother-of-pearl shells and of tortoise-shells. The imports are coarse cotton-cloth of different colours, coarse cutlery, thin and thick copper-wire, coarse China, arrack, anis-spirits, gongs or Chinese drums, very small red corals, and some other minor articles. Only the smaller islands, which form the northern part of the group, are visited by country vessels from Celebes, Amboyna, and Banda: sometimes a large vessel from Soorabbaya in Java arrives. The inhabitants of these islands go to the southern and eastern islands in their own boats, where they buy trepang and other articles. The number of foreign vessels visiting the islands amounts, according to Kolff, annually to about thirty, and they all go to Dobo, a port on the island of Wammer. Above two centuries ago the Dutch formed a commercial establishment on the island, and had for some time a military post. But though the trade was at first very lucrative, it soon yielded little profit, probably because the market was overstocked with those articles which were in request among the people; and the Dutch company abandoned the islands entirely. During their stay, the Dutch had introduced Christianity, which still maintains its ground in the islands of Mykor, Wammer, and Wockan, whilst the inhabitants of Wadyier have embraced the Mohammedan creed, which has extended thus far south from the Moluccas, but the number of Mohammedans is small. There are no clergymen on the islands, but there are a few schoolmasters, natives of Amboyna, who instruct the youths, read some parts of the bible and sing hymns with the congregation, which meet in small churches built by the Dutch. The majority of the inhabitants however are heathens, and it is even pretended that they have no religion. They seem however very much inclined to become Christians, but hitherto no missionaries have been sent to them. The heathens are Haraforas, according to Kolff, and quite different from the Christian and Mohammedan inhabitants, as to whom he does not state if they belong to the pure Malay race or not.

Inhabitants.—The Lesser Sunda Islands are evidently inhabited by two, if not three, different races of men. Those which lie west of Sapy Strait seem to be entirely peopled by the Malay race; but farther west the great bulk of the population has features materially different from the Malays, as is proved by their darker colour, their frizzled hair, and the form of their limbs. It is said that in these islands the Malays are mixed with Haraforas or Australian negroes. But the intermarriage between these two races seems to be doubtful, when the peculiar character of the natives of Cooksland or New South Wales, and of Van Diemen's Land, is considered. From the latest accounts it appears that the inhabitants of the northern coast of Australia, though they differ little in stature and features from those of the southern parts, are of a different character, and much superior in intellectual powers, and that a few of them have been converted to Mohammedanism. Information on this point will probably be collected at the new colony at Port Essington, when we shall be able to decide whether a mixture of the two races has taken place in these islands. The Haraforas who inhabit the Arroo Islands are certainly much more advanced in civilization than the natives of the southern coasts of Australia. In the interior of the larger of the Lesser Sunda Islands, as Timor and Wetter, a race of Haraforas however seems to exist, who in their intercourse with foreigners exhibit more the character of the Southern Australian than that of the inhabitants of the Arroo Islands. Perhaps a third race of men is found on the Tenimber Islands and on Rotti, for the inhabitants are described as exhibiting little or nothing of those features which distinguish the Malay race, and as resembling more the Europeans than any other people of Southern Asia. They seem also to speak a different language.

(Stavorinus's *Voyages to the East Indies*; Horsburgh's *India Directory*; Raffles's *History of Java*; Crawfurd's *History of the Indian Archipelago*; Moor's *Notices of the Indian Archipelago*, Singapore, 1837; Kolff's *Reize door den Weinig bekenden Zuidlijken Molukschen Archipel*: Earl's account of Kisser, in *Lond. Geogr. Journ.*, vol. x.)

SUNDA, THE STRAIT OF, is the most frequented thoroughfare between the Indian Ocean and the China Sea, and is generally navigated by vessels which proceed from the Atlantic to the islands of the Indian Archipelago and the eastern countries of Asia. It extends between 5° 40′ and 6° 50′ N. lat., and between 104° 55′ and 106° E. long., from south-west to north-east. Its northern shores are formed by the southern coast of Sumatra, and its south-eastern by the western parts of Java. Its length, measured along a line drawn through the middle of the strait, is about 68 miles; but along the coast of Sumatra, not including the wide and deep bays by which this part of the island is intersected, it is above 70 miles; and along the coast of Java, measured along the projecting headlands, it is about 85 miles. The strait is wide towards the Indian Ocean, but rather narrow where it opens into the Java Sea. The two headlands which form its western entrance, Flat Point in Sumatra, and First Point in Java, are nearly 55 miles from each other, and the two islands preserve in general this distance for nearly 50 miles proceeding eastward; but towards the eastern extremity of the strait the peninsula of Raja Bassa projects southward from the main body of Sumatra, and approaches the north-western coast of Java within 15 miles. This constitutes the width of the eastern portion of the strait for somewhat more than 20 miles. A row of islands, four in number, lies across the strait in an oblique direction between First Point in Java and the peninsula of Raja Bassa, and divide it into five straits. The largest, called Prince's Island, or Pulo Pontangh, is divided from First Point by a strait about 4 miles wide, called Prince's Strait, or the Behouden (Safe Passage), which was formerly used, and recommended as the best passage both to enter and depart from the strait; but, although it is still used by many ships, the preference is now generally given to the Great Channel, between Prince's Island and Crockatoa, or to that between the latter and Tamarind Island. Prince's

Island has the form of a horse-shoe: it extends north and south 10 miles, and about 18 miles east and west along the northern side. Towards the west the island is level and low, but towards the east it is hilly: two of the hills near the eastern shore rise to a considerable elevation, and serve as beacons. Nearly the whole island is covered with trees, and is only inhabited by some fishermen. The Great Channel, between Prince's Island and Crockatoa, is about 20 miles wide; and although without soundings or anchorage, it is much frequented, being the widest passage of the strait, and remarkably free from danger. The island of Crockatoa, extending north-north-west and south-south-east about 6 or 7 miles, and 4 or 5 in breadth, rises with a steep ascent on all sides, and has a peak at its southern extremity, which rises to a great elevation, so as to be considered the Fair-way Mark in entering the Strait of Sunda from the westward. It does not appear to be inhabited. The channel between Crockatoa and Tamarind Island is about 10 miles wide; and as it has regular soundings from 18 to 28 fathoms (mud), where ships can occasionally anchor, it is often preferred to the Great Channel, particularly by ships working out against the westerly monsoon. Tamarind Island, or Pulo Bessy, is nearly as large as Crockatoa, and also contains a high peak resembling a sugar-loaf. The channel between Tamarind Island and Pulo Sebooko is only three miles wide; and though free from danger, it is not much frequented. Pulo Sebooko is somewhat less than Tamarind Island; but also high, and covered with wood. The channel between this island and Raja Bassa Road is about 8 miles wide, and is frequently navigated by vessels returning from China, as it offers a more speedy voyage during the north-western monsoon, and as Raja Bassa Road is an excellent place for procuring good water and provisions.

Nearly in the centre of the eastern and more narrow portion of the strait is the island called Thwart-the-Way, which is more than four miles long from south to north, and moderately elevated, but surrounded by a sea inconveniently deep for anchoring. The channel between this island and Sumatra, called Zutphen Channel, is much frequented in the north-west monsoon by ships from the China Sea bound westward. At other seasons the preference is given to the southern channel, between Thwart-the-Way and the coast of Java, which is called Bantam Channel. Both passages are free from any danger, except near the shores of Java and Sumatra, where there are some islands and rocky shoals. The tides in this narrow part of Sunda Strait seem to be greatly influenced by the winds, and frequently resemble currents more than regular tides. The strongest current occurs in Zutphen Channel, in February and March, when it runs from 4 to 4½ miles an hour to the west-south-west, and requires great caution on the part of the navigator, especially in the vicinity of Hog Point, the most southern cape of Raja Bassa peninsula. At other times it runs about 3 miles an hour, more or less. In Bantam Channel, and near the island of Thwart-the-Way, its velocity varies between 2 and 3½ miles an hour; but near the coast of Java, only from 1 to 2 miles. The ebb-tide generally lasts fourteen hours, and is strong; whilst the flood-tide, which sets to the north-east, is moderate, except during the strength of the north-east monsoon.

Though this strait is the maritime high-road which connects the most populous and civilised countries of the globe, there is no town on its shores, not even a large village, though there are several places which afford safe and convenient anchorage. The most important and most frequented are Raja Bassa Road, on the eastern side of Lampong Bay in Sumatra, and Anger and Mewen Bay in Java.

(Stavorinus's *Voyages to the East Indies*; and Horsburgh's *India Directory*.)

SUNDAY, the first day of the week. [WEEK.] Besides the name of 'Sunday' (*dies solis*), it was called by the early Christians 'the Lord's day' (*ἡ ἡμέρα ἡ κυριακή, dies dominicus*, or simply *κυριακή, dominica*) from its being the day on which the resurrection of Christ took place; and it was kept sacred in commemoration of that event. [SABBATH.] The mode of keeping it appears to have varied with the circumstances of the Christians. In the first ages it is very improbable that they abstained entirely from worldly business, as the time of many of them was not at their own command. They seem however, as far as it was practicable, to have devoted the day to religious worship. For this purpose they were accustomed to assemble before daybreak; and we may infer from passages in the *Acts*, *Epistles*, and in Pliny's celebrated *Letter to Trajan*, that singing hymns, reading the Scriptures, prayer, preaching, and the celebration of the Lord's supper, formed parts of these services.

We have a few notices of the mode of keeping the Sunday during the first three centuries. As early as the end of the second century, abstinence from worldly business seems to have been customary. (Tertullian, *De Orat.*, c. 23.) It was accounted a day of rejoicing, a feast and not a fast, and to fast upon this day was deemed unlawful. Upon it the Christians prayed standing, instead of kneeling, to intimate the elevation of their hopes through their Lord's resurrection. The public worship of the Christians on the Sunday in the first two centuries is described by Justin Martyr (*Apolog.*), whose account is particularly interesting, and by Tertullian (*Apolog.*, c. 39; compare Euseb., *Hist. Ecc.*, iii. 3, and iv. 23.)

As soon as the Christian religion came to be recognised by the state, laws were enacted for the observance of the Sunday; Constantine (in 321) ordered the suspension of all proceedings in the courts of law, except the manumission of slaves, and of all other business except agricultural labour, which was allowed in cases of necessity (*Cod. Justin.*, iii., tit. 12, § 2, 3; *Cod Theodos.*, viii., tit. 8, § 1, 3); and, as Eusebius tells us (*Vit. Const.*, iv., 18, 19, 20) he forbade all military exercises on Sunday. The laws of Constantine were repeated by subsequent emperors, with additions, of which one of the most important is that of Theodosius II. (in 425), by which the games and theatrical exhibitions were forbidden on Sunday. (*Cod. Theodos.*, xv., tit. 7, § 1, 5.) The most strict of these laws is that of Leo and Anthemius. (460, *Cod. Justin.*, iii., tit. 12, § 8.) It should be observed that the provisions of most of these laws extend to all the principal sacred days observed by the Church.

In all Christian communities the Sunday has been observed with more or less strictness, the degrees of which seem to depend on three different views which are held respecting its character. Some regard all the provisions of the fourth commandment as extending to it, admitting however an exception in the case of 'works of necessity and mercy;' others agree with these in abstaining from worldly business and amusements, because they think that only thus can the mind be fitted for the religious services which are observed on this day; while others, viewing it as a day of rejoicing, a Christian festival, devote a part of the day to religious worship, and the remainder to recreation. To these views ought to be added a fourth, which, though never adopted, we believe, by any church, has been the opinion of many eminent theologians, namely, that there is no divine authority for making a distinction between Sunday and other days. The discussion of this question has been referred to under SABBATH.

(Mosheim's *Eccles. Hist.*, cent. i., pt. ii., c. 4; cent. ii., pt. ii., c. 4; cent. iv., pt. ii., c. 4; Neander's *Geschichte*, i., p. 513; ii., p. 640.)

SUNDAY, the first day of the week, a day kept holy by Christians. The common law is silent as to the observance of Sunday, and it seems once to have been the practice not only to exercise worldly callings on that day, but also especially to devote some part of it at least to sports and pastimes, such as now prevail in Continental countries, both Protestant and Roman Catholic. This practice continued till some time after the Reformation. Plays are said to have been performed on Sundays at the court of Elizabeth, and even of Charles I. The first restriction that appears among the printed statutes is by the 27 Hen. VI., c. 5, which enacts that all fairs and markets held on Sundays shall cease (the four Sundays in harvest excepted), on pain of the forfeiture of the goods exposed for sale. Immediately after the Reformation in England the legislature regulated the observance of Sunday. The first statute relative to the subject, the 5 and 6 Ed. VI., c. 3, recites that there is not any certain time, or definite number of days, prescribed in scripture to be kept as holy-days, but the appointment of them is left to the church, to be assigned in every country by the discretion of the rulers and the ministers thereof. (It is said to have been debated at Geneva whether the Reformed, for the purpose of estranging themselves more completely from the Romish church, should not adopt Thursday as the Christian Sabbath.) The statute proceeds to enact that certain days mentioned, such as Christmas Day, Good Friday, &c., and all Sundays in the

year, shall be kept holy-days; but it provides that in harvest, or any other time when necessity shall require, any kind of work may be done upon those days. No penalty is attached to the infringement of this act. It is said to have been drawn up under the inspection of Cranmer. By the 1 Eliz., c. 2, all persons having no lawful or reasonable excuse to be absent, are to resort to their accustomed parish church or chapel on Sundays, or to forfeit twelve pence, which was recoverable before justices. The party so offending is also made amenable to ecclesiastical censure, but is only liable to one punishment, be it ecclesiastical or civil. Soon after this time the Puritans and other strict religionists attained political influence. Heylin, in his answer to Burton (1636), says that their speculations about Sunday were first broached about forty years before, and that in none of the fathers, nor the early authorities of the church, can anything of the kind be found. They appear to have entertained a greater predilection for the history and economy of the Jews, as contained in the Old Testament, than had hitherto been exhibited in the Christian world. Borrowing its phraseology, they styled and considered themselves God's people, while they bestowed upon their enemies the title of Egyptians and Amalekites. At the same time they began to style Sunday, a term which they thought profane, as derived from Saxon idolatry, the 'Sabbath,' or 'The Lord's Day,' names which are not used in the statutes previous to that period. In accordance with this mode of thinking, they seem to have been of opinion that the Christian Sunday ought to be observed in the same manner as the Jewish Sabbath. It was with a view to counteract such opinions, that, in 1618, James I. wrote his 'Book of Sports,' in which he declares that dancing, archery, leaping, vaulting, May-games, Whitsun-ales ('ales,' Warton says, means 'festivals'), and morris-dances were lawful, and that no such honest mirth or recreation should be forbidden to his subjects on Sundays after evening service. He says the prohibition of them led to filthy tippling and drunkenness. Before his time the practice of archery on holy-days had been enjoined by various acts of parliament; and butts were directed to be set up for that purpose, at which the parishioners were to shoot after divine service. James however restrains Popish recusants from such liberty, as being unworthy of it from not having attended church, and commands each parish to use such recreations by itself, and prohibits all unlawful games, such as bear-baiting, bull-baiting, interludes, and bowling by the meaner sort. The 'Book of Sports' was re-published by Charles I. in 1638. (5 'Harleian Miscellany,' 75.) The Puritans however becoming the stronger party, their opinions prevailed, and there followed a rapid succession of enactments in furtherance of them. The 1 Ch. I., c. 1, enacts that there shall be no concourse of people out of their own parishes on the Lord's day for any sports or pastimes, and that no unlawful games, such as bear-baiting, &c., shall be held in any parishes, under a penalty of 3*s*. 4*d*. for each offence. The 3 Ch. I., c. 1, enacts that no carrier with any horse or horses, nor waggonman, carman, wainman, nor drovers, shall travel on the Lord's day, under a penalty of 20*s*.; and prohibits butchers from killing on that day. But the most important statute on the subject is 29 Ch. II., c. 7, which enacts (sect. 1) that no tradesman, artificer, workman, labourer, or other person whatsoever, shall do or exercise any worldly labour or business or work of their ordinary callings on the Lord's day (works of necessity and charity only excepted); and it prohibits the sale and hawking of wares and goods. Sect. 2 prohibits drovers, horse-coursers, waggoners, butchers, higglers, and their servants from travelling, and the use of boats, wherries, lighters, or barges, except on extraordinary occasions. By sect. 3 the dressing of meat in families, the dressing and selling it in inns, cook-shops, or victualling-houses, and crying milk before nine and after four, are excepted from the operation of the act. By sect. 6 persons are prohibited from serving or executing any process, warrant, &c. (except in cases of treason, felony, or breach of the peace) on the Lord's day: the service, &c. is made void, and the person serving it is made liable to damages, as if he had acted without any writ, &c.

By the 10 and 11 W. III., c. 24, mackerel are permitted to be sold before and after divine service on Sundays, and forty watermen are allowed to ply between Vauxhall and Limehouse. The 21 Geo. III., c. 49, enacts that no house, &c. shall be open for any public entertainment or amusement, or for publicly debating on any subject, on Sundays.

The 7 and 8 Geo. III., c. 75, repeals that part of 29 Ch. II. which relates to travelling by water. By 34 Geo. III., c. 61, bakers are enabled, between nine and one o'clock on Sundays, to bake for persons things which are brought to their oven. By 1 and 2 W. IV., c. 22, drivers of hackney-carriages may ply, and are compellable to drive on Sundays. The 3 W. IV., c. 19, empowers the court of aldermen, or two justices, to regulate the route of stage-carriages, cattle, &c. on Sundays. These two statutes relate to London only. The 3 and 4 W. IV., c. 31, provides that the election of corporate officers, &c., required to be held on any particular day, shall take place on Saturdays or Mondays, when the day specified in the act happens to be a Sunday.

Under these enactments the courts have determined that a contract or sale which, though made on Sunday, is not in the exercise of the ordinary calling of the parties, is valid. Thus a contract of hiring between a farmer and a labourer, and a bill of exchange drawn on a Sunday, have been held to be good. The owner of a stage-coach is not included within the provisions of any of the statutes on the subject, the words 'other person whatever,' in 29 Ch. II., being restricted in application to persons of the same classes as those enumerated by name. An action therefore may be maintained against him for neglecting to take a passenger. Only one offence can be committed by the same party against the provisions of 29 Ch. II., c. 7, by exercising his ordinary calling on a Sunday.

(Com., *Dig*., tit 'Temps,' B. 3; Burns's *Justice*, tit. 'Sunday;' Heylin's *History of the Sabbath*; D'Israeli's *Obs. on James I.*)

SUNDAY SCHOOLS. [SCHOOLS.]

SUNDERBUNDS. [HINDUSTAN, p. 217.]

SUNDERLAND, a parliamentary borough, partly in the eastern division of Chester ward, but chiefly in the northern division of Easington ward, in the county of Durham; 367½ miles from the General Post-office, London; namely, by railway to Warrington, 191 miles; and from thence to Manchester, 19¼ miles; Normanton, 50 miles; York, 23½ miles; Darlington, 44¾ miles; and Stockton, 12 miles; in all 340½ miles by railway; and from Stockton 27 miles by coach to Sunderland. The distance by the coach-road through Barnet, Baldock, Alconbury, Stamford, Newark, Doncaster, Boroughbridge, Thirsk, and Stockton is only about 269 miles.

The parliamentary borough of Sunderland comprehends the parish of Sunderland; the townships of Bishop Wearmouth and Bishop Wearmouth Pans, on the south side of the river Wear, in Easington ward; and the townships of Monk Wearmouth, Monk Wearmouth Shore, and Southwick, on the north side of the river, in Chester ward. The area of the borough is estimated at 5095 acres (*Report of the Commissioners of the Boundaries of Municipal Corporations*), or 5215 acres, according to the statement given in the Population Returns; with a population, in 1831, of 40,735, thus distributed:—

	Area in Acres.	Houses. Inhabited.	Uninhab.	Building.	Families.	Persons.
Sunderland parish	120	1744	49	4	4,478	17,060
Bishop Wearmouth township	3280	2226	61	65	3,442	14,462
Bishop Wearmouth Pans ditto	5	28	..	..	84	363
Monk Wearmouth ditto	590	234	22	1	354	1,498
Monk Wearmouth Shore ditto	250	670	15	6	1,601	6,051
Southwick ditto	970	231	10	6	257	1,301
	5215	5133	157	82	10,216	40,735

Northern or Monk Wearmouth was a place of some note in the Anglo-Saxon and Anglo-Norman period. A monastery was founded here in the year 674; and it is probable there had been a previous monastic foundation here, but of short duration. The monastery was destroyed by the Danes in the ninth century, and the site remained desolate above two hundred years, till after the Norman conquest, when it was restored, but was soon after reduced to be a cell of the monastery of St. Cuthbert, Durham. The revenues of the cell at the dissolution were only 25*l*. 8*s*. 4*d*. clear. The first notice of South or Bishop Wearmouth is in a charter of Hugh Pudsey, bishop of Durham, towards the close of the twelfth century, recognising a borough in the parish, and granting privileges to the burgesses similar to those of the burgesses of Newcastle. The borough is in the charter termed Weremue (Wearmouth), but it appears from its very origin to have had also the name of Sunderland.

Towards the close of the reign of Elizabeth the shipping of coal began, and the town of Sunderland increased considerably. In A.D. 1634 it received a new charter of incorporation from Bishop Morton. In the civil war of Charles I. it was garrisoned for the parliament, and several smart skirmishes were fought near it.

The parish of Sunderland, which was formed in 1719 by detaching a part of Bishop Wearmouth, occupies the point of land at the south side of the mouth of the Wear, and, with the exception of the town-moor or common of 70 acres, is covered with houses, all of them of considerable age. There is one street, broad and handsome, communicating with the High-street of Bishop Wearmouth, and lined with good houses: the other streets are merely narrow lanes, so densely peopled as to be dirty, and, apparently at least, unhealthy. Bishop Wearmouth was some time since a distinct town from Sunderland, but the progress of building has united them: the High-street of Wearmouth and of Sunderland form one line extending above a mile in length from north-north-east to south-south-west. The newer part of the town adjoining Sunderland has good streets and excellent houses: the wealthier classes reside here. Bishop Wearmouth is rapidly increasing; several new streets have been recently built, or are in course of building. The principal streets in Sunderland and Bishop Wearmouth are paved and lighted. Bishop Wearmouth Pans comprehends a small but densely peopled part along the bank of the river: it has glass-houses and iron-works for the manufacture of articles required by the shipping. Monk Wearmouth Shore is immediately opposite to Sunderland and a part of Bishop Wearmouth: it has a dense population, but few of the higher class. Monk Wearmouth adjoins Monk Wearmouth Shore, but lies back from the river. On the bank of the river, half a mile higher up than Monk Wearmouth, and extending inland, is Southwick; and opposite Southwick, in the township of Bishop Wearmouth, is the hamlet of Deptford, which is from a quarter to half a mile distant from Bishop Wearmouth town.

The river is crossed by an iron bridge of one arch, erected near the close of the last century. The abutments are piers of nearly solid masonry, twenty-four feet in thickness, forty-two feet broad at bottom, and thirty-seven at the top; the arch is of iron, and forms the segment of a large circle, having a span of 236 feet; the height above low-water is 60 feet to the spring and 94 feet to the centre of the arch, so that ships of 300 tons pass under it very readily by lowering their top-gallant masts. The superstructure is of timber planked over, with flagged foot-paths and iron balustrades. The cost of this bridge was as follows:—

	£	s.	d.	£	s.	d.
Obtaining act of parliament	687	2	6			
Consulting architects .	888	4	8			
Purchase of ground and houses	1,231	5	11			
				2,806	13	0
Materials for the bridge	13,547	4	1			
Labour, floats, boats, &c.	13,861	3	9			
				27,408	7	10
Interest of capital during building				2,699	18	9
Purchase of Sunderland Ferry . . .	6,300	0	0			
Purchase of Pann Ferry	1,600	0	0			
Law expenses thereon.	985	0	5			
				8,885	0	5
Total amount . .				61,800	0	0

Above the bridge, on the Bishop Wearmouth side, are very extensive staiths for shipping coals, belonging to the trustees of the late countess of Durham and the Hetton Coal Company; and on the opposite side other straiths, belonging to Messrs. Pemberton and Co. Their pit is distant only a few hundred yards. It is the deepest in England, being 280 fathoms below the surface. A little way higher up are the bottle-works of Ayre's Quay. The local staiths of the Durham and Sunderland Railway Company are situated on the lowest reach of the river on the Sunderland side. This Company conveys the coals of various collieries in the vicinity of the railway, which extends nearly to Durham; and being connected with other railways in the southern part of the county, it has also a considerable traffic in goods and passengers. A wet-dock, containing an area of nearly eight acres, with a tidal basin attached to it of about one acre, has been lately constructed by a private company on the low ground between Monk Wearmouth Shore and the sea, on the northern side of the river, and near the entrance to the harbour. An opening has been made through the North Ric to communicate with the river. A branch railway from the dock joins the Brandling Junction Railway, which again is connected with the Newcastle and Carlisle Railway; and thus a communication is established between the Irish Sea and the German Ocean.

Sunderland church is a spacious brick building, erected in the earlier part of the last century, with a square tower. There is an episcopal chapel, erected in 1769, near the east end of the town-moor; and a new church has been erected within the last few years with the aid of the parliamentary commissioners. The church of Bishop Wearmouth was very much altered in the early part of the present century; the chancel is antient, and has a fine east window divided into five lights with tracery. There are three episcopal chapels in the parish: one of these is at Ryhope, not in the borough of Sunderland; the others are within the borough. Monk Wearmouth church is a mutilated and irregular building, but has, especially in the tower, some very antient features. There is an episcopal chapel in Monk Wearmouth parish. There are a considerable number of dissenting places of worship.

There are a custom-house, an excise-office, and an exchange: the last is a neat building, erected nearly thirty years since, and comprises a merchants' walk, commercial room, news-room, auction-mart, and justice-room. On the town-moor of Sunderland are extensive barracks. There are a theatre and an assembly-room. There are also baths adjoining the town-moor, and at Hendon, a little way south of the town, where bathing-machines are much used in the season. There are a commodious and spacious market, and water-works and gas-works on a large scale. A new cemetery has lately been formed in a deep ravine contiguous to the town of Bishop Wearmouth, called the Rector's Gill. There has been lately erected in Bishop Wearmouth an elegant building, called the Athenæum, containing a large hall, with lecture theatre, museum, library, and other apartments for literary and scientific purposes. It cost about 5000*l.*

The preservation and improvement of the port and harbour of Sunderland are entirely owing to the exertions of commissioners who have been appointed under successive acts of parliament for levying certain dues and applying them to the cleansing and improving of the harbour. Of late years the amount of these dues averages annually about 16,000*l.* These works, and particularly the construction of piers on both sides of the mouth of the river, have had so great an effect in improving the port, that ships drawing from 15 to 18 feet of water can now enter and depart from the harbour with great safety. The building of the south pier was one of the first operations of the commissioners. It was commenced in 1723, and was extended in various lengths from time to time. In 1746 it was 333 yards long and 30 feet broad, built entirely of stone. The north pier was commenced in 1786 with timber or carcase-work, but a length of 700 feet of this pier was afterwards built with masonry upon piles. In the beginning of this century both piers were very considerably extended; but being executed in a superficial manner, they soon showed symptoms of decay, and it was considered necessary to rebuild the eastern or seaward portion of both of them. In 1821 that celebrated engineer the late Mr. Rennie recommended certain lines to be adopted; and 230 yards of the south pier wall was built under the superintendence of Mr. Mitton, then engineer to the commissioners, in a very substantial manner with ashlar masonry in blocks of stone varying from 5 to 7 tons in weight. This wall was properly backed with rubble-stone. The top of this portion of the pier is about 40 feet in width, divided into two parts, the one raised about 2 feet above the other as a promenade. A handsome parapet divides the raised platform from the rubble backing, which is now having its exterior surface rough-paved with the largest and heaviest blocks. The whole breadth of the pier from the harbour-wall to the foot of the glacis, in the widest part, is 250 feet. The length of this pier to its present eastern extremity is 650 yards. The eastern part of the north pier has been for the last

ten years in course of being rebuilt, under the direction of Mr. Murray, the present engineer to the commissioners, nearly in the same manner as the south pier just described, and the works are now rapidly drawing to a conclusion. The length of the north pier from its west to its east head is 590 yards. Near the termination of the north pier, in the year 1802, there was built an elegant octagonal lighthouse of polished stone, 62 feet in height from the cornice to the surface of the pier, which is here 12 feet above high-water of ordinary spring-tides. The top of the dome was 16 feet above the cornice, making a total height of 78 feet. Its breadth at the base was 15 feet, and 9 feet at the cornice. It was lighted with coal-gas from nine patent burners with parabolic reflectors. This lighthouse stood in the direct line of the new pier, and it was intended in the course of time to take it down and rebuild it in a proper situation. But in the beginning of 1841 an alarming breach took place in the old pier, contiguous to the site of the lighthouse, which made it imperative either to take down the building or to repair the pier in an expensive manner. Mr. Murray, the engineer, suggested to the commissioners the removal of it in an entire state to the eastern extremity of the new pier, a distance of nearly 150 yards. In April, 1841, the Board decided that he should commence operations. On the 15th of June the masons began to cut holes for the reception of a cradle, or platform of timber, which was threaded through the building balk after balk. This cradle was supported upon bearers with about 250 wheels of cast iron of 6 inches diameter, which were made to traverse on eight different lines of rails. The shaft of the lighthouse was tied together with bands, and its eight sides were supported with timber braces from the cradle upwards to the cornice. On the 2nd and 7th of August the building was carried 28 feet 6 inches in a north-easterly direction on to the new pier: it then took till the 30th of August to shore up the timbers and change the direction of the rails to carry it to the eastward. On the 4th of October it was finally brought to its destination in the centre of the new pier-head; and the timbers have been since removed, and the masonry underset with solid stone and pozzuolana mortar. There is not the slightest appearance of a crack in any part of the building. The light was exhibited nightly during the operation of removal. The gross weight moved was 338 tons. This was effected by three winches fixed upon the pier a little way in front of the building, and these were connected with the cradle above mentioned by ropes passing through twofold and threefold sheaves. Ten men to each winch were employed to carry the building forward when it was required. The total sum expended on this work was 827*l.* The original cost of the building, in 1802, was upwards of 1400*l.* Mr. Murray has, since the completion of this undertaking, received the thanks of the Board of Commissioners for his exertions, and a piece of plate of the value of 100*l.* has been presented to him as a further acknowledgment of his services on that occasion.

The principal manufactures of Sunderland are of bottle and flint glass, anchors, chain-cables and other iron goods for ships, and cordage. Ship-building is carried on to a greater extent than in any other seaport of the British empire. Upwards of 300 ships of various burthens were launched during the year 1839. Pigot's 'Directory' for 1834 enumerates about a hundred and thirty firms engaged in business in connection with this branch of industry, as ship-builders, boat-builders, chain-cable manufacturers, sail-cloth manufacturers, anchor and ship smiths, rope, sail, mast, block, or pump makers; besides ship owners, brokers, and chandlers. Some of the ropewalks are on a very large scale. Brick-making, digging coal, and the quarrying of grindstones are carried on in the neighbourhood; and there are copperas-works, brass-foundries, potteries, hat-manufactories, lime-works, timber-yards, saw-mills, flour-mills, tan-yards, and breweries. The town is however more important from its commerce than its manufactures. In shipping coal it is exceeded only by the port of Newcastle, and lately perhaps by Stockton. The state of the coal-trade in 1838-9 was as follows:—

	1838. Tons.	1839. Tons.
Shipped coastwise .	948,429	913,960
Shipped to foreign parts	308,168	370,620
	1,256,597	1,284,580

The export of lime is another principal branch of trade: also the export of glass and grindstones. The imports are timber and iron from the Baltic: butter, cheese, and flax from Holland; and a variety of goods brought coastwise. A considerable fishery is carried on. The number of registered vessels belonging to the port in 1832 was 728, their tonnage 129,309; the number of men composing their crews 5728. There are six banking establishments. The market, formerly held on Friday, is now on Saturday: there is also a cattle-market, and there are two yearly fairs.

The living of Sunderland is a rectory, united with the chapelry of the Episcopal chapel: the joint clear yearly value is 386*l.*, with a glebe-house. The living of Bishop Wearmouth is a rectory (to which one of the Episcopal chapels in the borough is united), of the clear yearly value of 2899*l.*, with a glebe-house. The living of Monk Wearmouth is a parochial chapelry, of the clear yearly value of 225*l.* Monk Wearmouth is in the rural deanery of Chester; Sunderland and Bishop Wearmouth in the rural deanery of Easington: all are in the archdeaconry and diocese of Durham.

Sunderland was made a Parliamentary borough by the Reform Act; and its boundaries (given above) were determined by the Boundary Act. It returns two members. The number of voters on the register, in 1835-6, was 1484: in 1839-40, 1657.

The corporation of Sunderland had gone nearly into disuse at the time of the Municipal Reform Act: the corporate body consisted of twelve freemen and eighteen stallingers: they had no jurisdiction or municipal authority: they held the town-moor and some other property of little account: the paving, lighting, watching, and cleaning the town were executed under a local act. By the Municipal Reform Act, the parliamentary boundaries were adopted for those of the municipal borough, which was to have a commission of the peace, and to be divided into seven wards, with 14 aldermen and 42 councillors. The Commissioners of the Boundaries of Municipal Corporations have recommended a more contracted boundary, and a division into s[illegible] ad of seven.

There were in the borough, in 1834, one infant and one dame-school, with 136 children (57 boys and 79 girls); ninety-seven day-schools of all sorts, with 4253 children (2465 boys and 1752 girls, and 36 children of sex not stated): two of the day-schools were also Sunday schools, and were attended on Sunday by 505 children (301 boys and 204 girls). There were also twenty-five Sunday-schools, with 3367 children, namely 1617 boys and 1750 girls. There were an auxiliary Bible society, a ladies' church missionary association, a religious tract society, an infirmary, a dispensary, numerous almshouses, and friendly and benefit societies, a mechanics' institute, a subscription library, a reading society, news-rooms, a law library and a Wesleyan library. Two weekly newspapers are published at Sunderland.

(Surtees's *Hist. of Durham; Parliamentary Papers.*)

SUNDERLAND, HENRY SPENCER, FIRST EARL OF (of that name), was born in 1623, and was the eldest son of Henry, second Baron Spencer of Wormleighton, which title he inherited on his father's death in December, 1636. While still a minor he married the beautiful lady Dorothy Sydney, daughter of the earl of Leicester, and sister of Algernon Sydney, the Sacharissa of the poet Waller; but on the breaking out of the civil war, and the erection of the royal standard at Nottingham, in August, 1642, Lord Spencer conceived himself bound in honour to repair thither, although, like many others who took the same course, by no means desirous of setting the prerogative above the law, but rather siding with the king against the parliament as only the least unhappy alternative offered by the crisis. Some confidential and affectionate letters to his wife, which are printed in Collins's 'Sydney State Papers,' show the position in which he found himself, and the feelings with which he regarded the royal cause. In one dated Shrewsbury, 21st September, 1642, he says: 'How much I am unsatisfied with the proceedings here, I have at large expressed in several letters. Neither is there wanting, daily, handsome occasion to retire, were it not for grinning honour. For let occasion be never so handsome, unless a man were resolved to fight on the parliament side, which, for my part, I had rather be hanged, it will be said without doubt that a man is afraid to fight. If there could be an expedient found to salve the punctilio

of honour, I would not continue here an hour. The discontent that I and other honest men receive daily is beyond expression.' Very much of the discontent here spoken of seems to have arisen from the influence in the royal councils possessed by the popish party, already strong in the support of the queen. Lord Spencer however, although he did not accept any military commission, drew his sword with the rest, and distinguished himself by his gallantry when the two armies joined battle for the first time at Edgehill, 23rd October, 1642. The following year, on the 8th of June, he was raised (it has been said, as a reward for accommodating the king with the loan of 15,000*l.*) to the title of Earl of Sunderland, a title which had become extinct about three years before by the death of Scrope, earl of Sunderland (previously Lord Scrope), upon whom Charles had conferred it in the beginning of his reign. But on the 19th of September thereafter, the new-made earl fell at the (first) battle of Newbury, the same fatal fight which deprived the king of the earl of Carnarvon, and Clarendon's great hero Lord Falkland. The royalist historian describes the Earl of Sunderland as 'a lord of great fortune, tender years (being not above three and twenty years of age), and an early judgment; who, having no command in the army, attended upon the king's person under the obligation of honour; and, putting himself that day in the king's troop a volunteer, before they came to charge was taken away by a cannon bullet.' By his wife, who afterwards married Robert Smythe, Esq., he left a son, who succeeded him in the peerage, a daughter, Dorothy, who became the wife of Charles II.'s famous minister, the first marquis of Halifax, and another daughter, Penelope, who died unmarried.

SUNDERLAND, ROBERT SPENCER, SECOND EARL OF, the only son of Henry, the first earl, was probably born in 1641 or 1642. His first entrance into public life appears to have been in 1671, in the latter end of which year he was nominated ambassador to Spain. In 1672 he went to Paris in the same capacity, and he was one of the three plenipotentiaries appointed to proceed to Cologne in the following year, when England and France were engaged in a war with the Emperor, Spain, and Holland, to open negociations for a general peace, which however proved abortive. He had already evinced a remarkable talent in the conduct of affairs. 'Lord Sunderland,' says Burnet, in mentioning this appointment, 'was a man of a clear and ready apprehension, and a quick decision in business. He had too much heat both of imagination and passion, and was apt to speak very freely both of persons and things. His own notions were always good (the bishop seems to mean correct or judicious); but he was a man of great expense......He had indeed the superior genius to all the men of business that I have yet known.' In 1678, on the recall of Mr. Ralph Montague from Paris, at the instigation of the duchess of Portsmouth, whose enmity and vengeance he had incurred by being detected in making love at the same time to herself and her daughter, Sunderland was again sent ambassador to France; but on the change of government at home in the beginning of the following year, he was recalled and made secretary of state in the room of Sir Joseph Williamson. From this time at least, if not from an earlier date, Sunderland especially attached himself to the duchess of Portsmouth, availing himself of her patronage or instrumentality as one of the principal props of his ambition. At first he and lords Essex and Halifax united in opposing Shaftesbury on the question of excluding the duke of York, and, keeping the chief direction of the state in their hands, they were popularly styled the triumvirate. 'Lord Sunderland,' says his friend and admirer Burnet, 'managed foreign affairs, and had the greatest credit with the duchess of Portsmouth.' This original triumvirate however did not last long: before the end of the year Sunderland had shaken off both the others; and the kingdom was now governed by a new junta, consisting of himself, Lord Hyde, and Godolphin. To this date is to be assigned the commencement of Sunderland's relation with the prince of Orange, afterwards King William. Burnet states that he entered into a particular confidence with the prince, 'which he managed by his uncle, Mr. Sidney, who was sent envoy to Holland.' He and Godolphin now also followed the duchess of Portsmouth in declaring openly for the exclusion. But immediately after the dissolution of the last of the exclusion parliaments, in March, 1681, another change of government suddenly threw Sunderland, with the rest of the popular members of the administration, out of office. Evelyn has a notice of him immediately after this, which is interesting:—'16 May (1681). Came my Lady Sunderland to desire that I would propose a match to Sir Stephen Fox for her son Lord Spencer to marry Mrs. Jane, Sir Stephen's daughter. I excused myself all I was able. She was now his only daughter, well bred, and likely to receive a large share of her father's opulence. Lord Sunderland was much sunk in his estate by gaming and other prodigalities, and was now no longer secretary of state, having fallen into displeasure of the king for siding with the Commons about the succession; but this I am assured he did not do out of his own inclination, or for the preservation of the Protestant religion, but by mistaking the ability of the party to carry it.' Evelyn, pressed by the lady, went through the form of executing her commission; but his interview with Sir Stephen merely ended in an understanding between them that nothing more should be done in the matter, and that he should 'put it off' as civilly as he could. Sunderland's fortunes however soon brightened again. In January, 1682, he was recalled to office: 'the king,' says Burnet, 'had so entire a confidence in him, and Lady Portsmouth was so much in his interests, that, upon great submissions made to the duke, he was again restored to be secretary.' Hyde, now created Viscount Rochester, was, it seems, the person who prevailed upon the duke to accept the said submissions, for which he incurred the implacable enmity of Halifax, who, Burnet tells us, 'hated Lord Sunderland beyond expression, though he had married his sister;' but this did not prevent Sunderland from, a few years after, becoming Rochester's rival and enemy. He remained in power during the rest of this reign; and notwithstanding that he had again been detected towards its close in intriguing, along with the duchess of Portsmouth, Godolphin, and the French ambassador Barillon, for the exclusion of James from the throne, when that prince became king he was not only retained in office, but acquired a greater ascendancy in the administration than ever. This extraordinary fortune he owed in part to his admirable talents for business, which made him almost indispensable; in part to his equally unrivalled skill in the art of insinuation, a skill moreover which he practised with the great advantage of being utterly unrestrained either by principle (at least as commonly understood) or by any attempt to preserve the appearance of consistency.

He now found a new patron in the queen, to whom he professed to give himself entirely up. When the marquis of Halifax was turned out for refusing to vote for the repeal of the Test Act, Sunderland was, in the beginning of December, 1685, declared president of the council, still retaining his place of secretary. 'Lord Sunderland,' writes Evelyn, in February following, 'was now secretary of state, president of the council, and premier minister.' And again, on the 12th of May, 1687,—'Lord Sunderland, being lord president and secretary of state, was made knight of the garter and prime favourite.' It is worthy of notice that all this success in political life was achieved by Sunderland without the faculty of public speaking: he scarcely ever opened his lips to express more than a simple assent or dissent either in parliament or at the meetings of the cabinet. There is a curious account of his drawling, affected mode of utterance, when he did say a few words, in North's *Examen*, p. 77. One of his methods of dispatching business also was sufficiently singular, if we may believe Lord Dartmouth, who, in a note upon Burnet's 'History,' tells us, on the authority of one of Sunderland's clerks, that 'he never came to the secretary's office, but they carried the papers to him at his house, where he was usually at cards, and he would sign them without reading, and seldom asked what they were about.'

Throughout James's unhappy reign the principal direction of affairs was in the hands of Sunderland and Father Petre (whom he made use of with his usual dexterity), they two constituting what was called the secret council. At last Sunderland, about the end of the year 1687, fairly turned Roman Catholic. 'He made the step to popery,' says Burnet, 'all of a sudden, without any previous instruction or conference; so that the change he made looked too like a man who, having no religion, took up one rather for to serve a turn than that he was truly changed from one religion to another.' To make matters even however Lady Sunderland took to professing

a hotter Protestantism than ever. The princess (afterwards queen) Anne writes to her sister the princess of Orange, 13th March, 1688: 'This worthy lord does not go publicly to mass, but hears it privately at a priest's chamber, and never lets anybody be there but a servant of his. His lady too is as extraordinary in her kind; for she is a flattering, dissembling, false woman; but she has so fawning and endearing a way that she will deceive anybody at first, and it is not possible to find out all her ways in a little time. She cares not at what rate she lives, but never pays anybody. She will cheat, though it be for a little. Then she has had her gallants, though maybe not so many as some ladies here; and, with all these good qualities, she is a constant church woman: so that to outward appearance one would take her for a saint, and, to hear her talk, you would think she were a very good Protestant; but she is as much one as the other; for it is certain that her lord does nothing without her.' And again, under date of the 20th:—'I can't end my letter without telling you that Rogers's wife (*i.e.* Lady Sunderland) plays the hypocrite more than ever: for she goes to St. Martin's morning and afternoon because there are not people enough to see her at Whitehall chapel, and is half an hour before other people come, and half an hour after everybody is gone, at her private devotions. She runs from church to church after the famousest preachers, and keeps such a clatter with her devotions that it really turns one's stomach. Sure there never was a couple so well matched as she and her good husband; for as she is throughout in all her actions the greatest jade that ever was, so he is the subtilest working villain that is on the face of the earth.' (Dalrymple's *Memoirs*, Append., part i., pp. 299-301.) Against all this indeed, Lady Sunderland, who was undoubtedly a woman of remarkable talents, ought to have the benefit of the high character given of her by Evelyn, who, after telling us that she is one whom, for her distinguished esteem of him, from a long amd worthy friendship, he must ever honour and celebrate, adds, 'I wish from my soul the lord her husband, whose parts and abilities are otherwise conspicuous, was as worthy of her as, by a fatal apostasy and court ambition, he has made himself unworthy. This is what she deplores, and it renders her as much affliction as a lady of great soul and much prudence is capable of.' (*Diary*, 18 July, 1688.) It is known now however that if Lady Sunderland professed to Evelyn to be opposed to the courses her husband pursued, she must have been imposing upon him; for she was certainly his confidant and associate in the darkest of his political intrigues and duplicities. As for Sunderland, one excuse that has been made on highly probable grounds for the worst things he did during his administration of affairs under James is, that he was all the while in secret league with the Prince of Orange and doing his best to drive matters to a revolution. 'After the revolution,' says Lord Dartmouth, 'he and his friends for him pleaded that he turned papist for the good of the Protestant religion;' and Burnet, in the passage to which this note is appended, admits that his change of religion had since been imputed to his desire 'to gain the more credit, that so he might the more effectually ruin the king.' James however at last either came to suspect him or thought to lighten the crazy vessel of the state by throwing the unpopular minister overboard. He was dismissed on the 28th of October, 1688. 'This change,' says the 'History of the Desertion,' 'pleased all men, but it came too late.' Evelyn writes, under date of the 29th, 'Lady Sunderland acquainted me with his majesty's taking away the seals from Lord Sunderland, and of her being with the queen to intercede for him. It is conceived that he had of late grown remiss in pursuing the interest of the Jesuitical counsels; some reported one thing, some another; but there was doubtless some secret betrayed which time may discover.'

On the arrival of the Prince of Orange, Sunderland went over to Amsterdam, whence however he and his wife wrote to the prince, claiming his protection on the ground that they had all along been in his interest. (See their Letters, in Dalrymple, Append., part ii., pp. 3-5.) On the 23rd of March, 1689, also, Sunderland published at London a defence of his conduct in the form of a letter to a friend, which is printed in the 'History of the Desertion,' pp. 28-33, and in Cogan's 'Tracts,' vol. iii. Here he professes, but does not support his assertions by any evidence, to have all along done his utmost, though unsuccessfully, to check James's illegal and headlong course, only taking blame to himself for consenting to remain in office when his advice was so entirely disregarded. The statement contains also some very thickly laid on flattery of King William. 'Sometime after,' he says in one place, 'came the first news of the prince's designs, which were not then looked on as they have proved, nobody foreseeing the miracles he has done by his wonderful prudence, conduct, and courage; for the greatest thing which has been undertaken these thousand years, or perhaps ever, could not be effected without virtues hardly to be imagined till seen nearer hand.' The conclusion of this precious effusion is rich:—'I he,' says his lordship, 'under many other misfortunes and afflictions extreme heavy, but I hope they have brought me to reflect on the occasion of them, the loose, negligent, unthinking life I have hitherto led, having been perpetually hurried away from all good thoughts by pleasure, idleness, the vanity of the court, or by business; I hope, I say, that I shall overcome all the disorders my former life had brought upon me, and that I shall spend the remaining part of it in begging of Almighty God that he will please either to put an end to my sufferings or to give me strength to bear them; one of which he will certainly grant to such as rely on him, which I hope I do, with the submission that becomes a good Christian.' Sunderland, who had of course been excepted out of the act of indemnity, remained abroad about two years, and then, not a little to the surprise of the general public, returned to be taken into favour by the new king. Under date of the 24th of April, 1691, Evelyn writes: 'I visited the Earl and Countess of Sunderland, now come to kiss the king's hand, after his (the earl's) return from Holland. This is a mystery.' For some years he did not take any public office, but it was well understood that he was nevertheless William's principal adviser. The admission of the Whigs to a share in the government, which took place in 1693, when Trenchard was made secretary of state and Somers keeper of the great seal, was well known to be his doing. Burnet says, 'The bringing these men into those posts was ascribed chiefly to the great credit the Earl of Sunderland had gained with the king; he had now got into his confidence, and declared openly for the Whigs.' In the course of a progress through the northern counties, in November, 1695, his majesty spent seven or eight days at Sunderland's magnificent house at Althorpe, 'which,' says Burnet, 'was the first public mark of the high favour he was in.' On the 1st of December following, Evelyn records, 'I dined at Lord Sunderland's (in London), now the great favourite and underhand politician, but not adventuring on any character, being obnoxious to the people for having twice changed his religion.' Immediately after this he was made lord chamberlain: Lord Dartmouth asserts that the king gave the Earl of Dorset 10,000*l.* to resign in his favour; 'upon which,' he adds, 'Lord Norris fell very violently upon him in the House of Commons, as a man whose actions had been so scandalous during his whole life, that he never had any way to excuse one crime but by accusing himself of another; therefore hoped they would address his majesty to remove him from his presence and councils, which, though not seconded, was universally well received.' In a note on the same passage of Burnet's 'History,' Lord Hardwicke says, 'I have always been persuaded, from the signal confidence which King William reposed in this lord through the whole course of his reign, that he had received some particular services from him at the time of the Revolution which no one else could have performed.' According to the usage of that day, Sunderland, as lord chamberlain, took his seat at the council-table; and he continued to direct affairs as the acknowledged head of the government for about two years longer. At last, in the end of the year 1697, he thought proper suddenly to resign his office, and to retire into private life. 'He was often named,' says Burnet, 'in the House of Commons with many severe reflections, for which there had been but too much occasion given during the two former reigns. The Tories pressed hard upon him, and the Whigs were so jealous of him, that he, apprehending that, while the former would attack him, the others would defend him faintly, resolved to prevent a public affront, and to retire from the court and from business; not only against the entreaties of his friends, but even the king's earnest desire that he would continue about him: indeed, upon this occasion his majesty expressed such a concern and value for him, that the jealousies were increased by the confidence

the court saw the king had in him. During the time of his credit things had been carried on with more spirit and better success than before; he had gained such an ascendant over the king, that he brought him to agree to some things that few expected he would have yielded to; he managed the public affairs, in both Houses, with so much steadiness and so good a conduct, that he had procured to himself a greater measure of esteem than he had in any of the former parts of his life; and the feebleness and disjointed state we fell into after he withdrew contributed not a little to establish the character which his administration had gained him.' A note of Speaker Onslow's upon this passage, which is too long to be extracted, records some curious particulars which show the panic precipitation with which Sunderland fled from what his fears represented to him as impending restruction. He never returned to court, but spent the demainder of his life at Althorpe, where he died on the 28th of September, 1702.

It is said that when Edmund Smith was applied to by Addison, at the instance of the Whig ministry of Queen Anne's time, to write the history of the Revolution, he started an objection to which no reply could be made, by asking, 'What shall I do with the character of Lord Sunderland?' The best thing perhaps that can be done in the case, is to allow the facts of his history to speak for themselves—which they do plainly enough.

Lord Sunderland's wife was Anne, daughter of George Digby, second earl of Bristol. Pepys, speaking of Lord Bristol, under date of 1st July, 1663, says, 'I hear also of another difficulty now upon him, that my Lord of Sunderland (whom I do not know) was so near to the marriage of his daughter, as that the wedding-clothes were made, and portion and everything agreed on and ready; and the other day he goes away, nobody yet knows whither, sending her the next morning a release of his right or claim to her, and advice to his friends not to inquire into the reason of this doing, for he hath enough for it; and that he gives them liberty to say and think what they will of him, so they do not demand the reason of his leaving her, being resolved never to have her.' If this strange story be true, Sunderland would seem to have been at his manœuvres and mysteries at a very early age, and long before he commenced his political career. There are numerous notices of Lady Sunderland in Evelyn's 'Diary.' She seems to have taken pains to ingratiate herself with the good old man. Of the children of Lord and Lady Sunderland, the eldest son, Robert, died unmarried, in France, before his father, so that the title fell to the second son, Charles. Evelyn, who knew all the family well, speaks very unfavourably of the elder brother. Of several daughters, one, Elizabeth, was married to the earl of Clancarty in Ireland; another, the Lady Anne, described by Evelyn as 'a young lady of admirable accomplishments and virtue,' to James Lord Arran, the eldest son of the duke of Hamilton, but she died in 1690, before her husband succeeded to the title.

SUNDERLAND, CHARLES SPENCER, THIRD EARL OF, the second son of Robert, second earl, was born in 1674. Evelyn mentions him in 1688 as 'a youth of extraordinary hopes, very learned for his age, and ingenious, and under a governor of great worth.' From Swift's 'History of the Last Four Years of Queen Anne,' this governor or tutor appears to have been Dr. Trimnell, afterwards Bishop of Winchester. He was returned to the House of Commons for Tiverton at the general election in 1695; and he sat for the same place in the three succeeding parliaments, which met in December, 1698, in February, 1701, and in December, 1701. The death of his father made him a peer about six months after the accession of Anne, and before her first parliament met. He had become Lord Spencer, by the death of his elder brother, before 1690; but in his father's lifetime,' says Swift, 'while he was a member of the House of Commons, he would often, among his familiar friends, refuse the title of Lord (as he hath done to myself), swear he would never be called otherwise than Charles Spencer, and hoped to see the day when there should not be a peer in England.' It is remarkable that in the lists of members given in the 'Parliamentary History' he is always called 'Charles Spencer,' without any title. Afterwards however it was noted that he had 'much fallen from the height of those republican principles with which he began.' His first public employment was his appointment as envoy extraordinary and plenipotentiary to the court of Vienna in 1705, on the accession of the emperor Joseph. Some years before this he had married (for his second wife) a daughter of the duke of Marlborough; and this connection led to his being selected by the Whig section of the ministry to displace Sir Charles Hedges, when, in December, 1707, they found themselves strong enough to force the queen to give them a person of their own politics as one of the secretaries of state, their opponent Harley still continuing to be the other, which he did however only for a few months. The history of this movement is told at great length by the duchess of Marlborough, in her 'Account of her Conduct,' p. 172, &c. Its result was to produce a completely Whig government, in which Sunderland retained his office of secretary till June, 1710, when his dismissal, without any reason being assigned, was the first intimation of the complete break-up of the ministry, which immediately followed. It is said that Anne, who never liked the notion of taking away a man's income, even when she wished to deprive him of power, offered to compensate Sunderland when thus turned off by a pension of 3000*l.* a year, to which he replied, that 'he was glad her majesty was satisfied he had done his duty; but if he could not have the honour to serve his country, he would not plunder it.' He remained out of office for the rest of this reign; but the ability he had shown during the short time he was a member of the government, and the prominent part he continued to take in the debates of the House of Lords, made him be generally regarded as the head of the Whig party, and the man most likely to be placed at the head of affairs when the Hanover family should come to the throne. When George I. came over, in September, 1714, he was received with distinguished marks of regard by his majesty; such indeed as could not be omitted to one who had always been looked upon as the most devoted friend of the Hanoverian succession: but it had already excited some surprise that he had not been nominated one of the lords justices to whom the government was committed on the death of the queen, and it soon appeared that there was another interest more powerful than his at the new court. His rival was Lord Townshend, the friend of Walpole, who had obtained the first place in the favour of Bothmar, the Hanoverian resident, and who, on his recommendation, was now appointed secretary of state, while Sunderland was obliged to put up with the lord-lieutenancy of Ireland, which he considered a kind of exclusion and banishment. 'Though he did not openly show his disgust,' says Coxe, 'yet he scarcely took any active part in defending the measures of government. He, who was before accustomed to make a conspicuous figure in every debate, seems to have remained almost uniformly silent; and from the accession of George I. till the beginning of 1717 his name seldom occurs in the proceedings of the House of Lords.' It is probable that his relationship to the duke of Marlborough, who was personally disliked by George I., had much to do with his being thus kept in the background. In August, 1715, soon after the death of the marquis of Wharton, he was made lord privy seal; but this place still gave him little or no share in the direction of affairs, and did not remove his disgust. Nor did he remain inactive. On the contrary, he sought support for himself, and the means of annoying and weakening his opponents, from all quarters. He 'increased his party,' says Coxe, 'with a number of disaffected persons. He particularly gained among the Whigs Carleton, Cadogan, Lechmere, and Hampden; courted the Tories; entered into cabals against his colleagues; and was prepared to use all his efforts and employ any opportunities which might offer to prejudice the king against them.' His majesty had gone over to Hanover, attended by secretary Stanhope, in July, 1716. 'One of the principal charges,' says Coxe, 'which Stanhope had received from his friends in England was to be on his guard against the intrigues of Sunderland, who had, under pretence of ill health, obtained the king's permission to go to Aix-la-Chapelle. Although at the time of his departure he had given the most positive assurances of repentance and concern for his late endeavours to remove his colleagues, and, after the most solemn professions of friendship and union, had condescended to ask their advice for the regulation of his conduct at Hanover, to which place he intended to apply for leave to proceed, Townshend and Walpole suspected his sincerity: they had experienced his abilities; they knew his ambition; and they dreaded the ascendancy which he

might obtain, through the channel of the Hanoverians, over the king. But they implicitly trusted in the sagacity and integrity of Stanhope, either to prevent his appearance at Hanover, or, if he came, to counteract his views. Stanhope however did not follow their directions; for when Sunderland demanded access to the king, instead of opposing, he promoted the request with all his influence.' The result was that Sunderland, who had arrived at Hanover in the latter part of October, soon acquired the complete confidence both of the king and of Stanhope. Lord Townshend, after much complicated manœuvring and intriguing by the faction in whose hands the king was, and much indecision on the part of his majesty himself, was removed; Sunderland was in the first instance appointed treasurer of Ireland for life, resigning his office of lord privy seal to the Duke of Kingston; and finally, in April, 1717, a complete reconstruction of the ministry was effected by the resignation of Walpole, Devonshire, Pulteney, and others of their friends, and by the appointment of Sunderland and his friend Addison as secretaries of state (the former also holding for some months the presidency of the council, which he eventually resigned to the Duke of Kingston), with Stanhope as first lord of the treasury and chancellor of the exchequer—an arrangement which about a year after was modified by Stanhope (now a peer) taking the office of secretary, and Sunderland, who had all along been the head of the government, going himself to the treasury, the chancellorship of the exchequer being given to Mr. Aislabie. [STANHOPE, JAMES, EARL.] About the same time the opportunity was taken of substituting Craggs for Addison as the other secretary.

On the 5th of March, 1719, the famous bill for limiting the number of peerages was first brought into the House of Lords. 'This bill,' says Coxe, 'was projected by Sunderland: his views were to restrain the power of the Prince of Wales when he came to the throne, whom he had offended beyond all hopes of forgiveness, and to extend and perpetuate his own influence by the creation (of course the reverend historian must mean before the measure should pass) of many new peers.' The bill was abandoned that session; but it was brought forward again in the next, the first of a new parliament, when it was passed by the Lords, 30th November, 1719, apparently without a division, and was only defeated in the Commons, after it had been read a second time, on the motion for its committal, principally by the strenuous exertions of Walpole. Coxe asserts that before the new parliament met no means had been left unemployed by Sunderland to secure the success of this measure; 'bribes were profusely lavished; promises and threats were alternately employed, in every shape which his sanguine and overbearing temper could suggest.' Now that he found himself signally beaten however—for Walpole's eloquence and influence had procured the triumphant majority of 269 to 177 against the ministerial project—he deemed it his best policy to enter into an alliance with the potent commoner; and accordingly, in the beginning of June, 1720, Walpole and his friend Townshend were both reinstated in the government, the former being appointed paymaster of the forces, the latter president of the council. This proved a fortunate arrangement for Sunderland: in the beginning of the following year came the investigation by the House of Commons into the transactions connected with the South Sea scheme, in which Sunderland, with others of the ministers, had been deeply involved; the secret committee had reported that of the fictitious stock distributed by the directors of the company, with the object of influencing or bribing the government and the legislature, 50,000*l.* had been given to Sunderland; Lord Stanhope and Secretary Craggs, who were also implicated, had only escaped prosecution by having both suddenly died in the midst of the investigation, nor did even his death save the estate of the latter; Aislabie, the chancellor of the exchequer, had already been expelled and committed to the Tower; when, on the 8th of March, Walpole's earnest entreaties with difficulty prevailed upon the House to adjourn the consideration of the part of the committee's report relating to Lord Sunderland till the 15th. In the interval Walpole exerted himself privately to gain votes for an acquittal by representing to his Whig friends in strong colours the disgrace and possible ruin that would be brought upon their party by the conviction of the prime minister. 'His personal weight,' to adopt the language of Coxe, 'his authoritative and persuasive eloquence, were effectually employed on this occasion, and, aided by the influence of government, met with success. The minister was acquitted by a majority of 61 votes, 233 against 172.' It is right to state however that the evidence in support of the charge was far from being perfectly satisfactory, coming as it did principally from one of the directors, himself convicted of gross fraud. 'Although the public voice,' Coxe adds in a note, 'notwithstanding his acquittal by so large a majority, criminated Sunderland, yet several extenuations may be urged in his favour. For it appears from private documents which have casually fallen under my inspection, that so early as July he had refused to recommend to the directors any more lists for subscriptions; that he did not at least enrich himself or his friends; that he expressed great satisfaction that neither himself nor his friends had sold out any South Sea Stock, as he would not have profited of the public calamity.' It is said that if he had sold out the stock he held at one time, he might have realised by it not less than 300,000*l.*

Notwithstanding his acquittal, it was found impossible to retain him in office; he was very reluctant to go out, and the king was equally averse to parting with him: in particular, it is said, he desired to be allowed to retain the disposal of the secret service money; but he was at last forced to give up everything, and on the 3rd of April Walpole was appointed both to his place of first lord of the treasury, and to that of chancellor of the exchequer, of which Aislabie had been deprived. Sunderland however still retained the most unbounded influence over the king; he even regulated the appointments to the highest offices in the government, carrying his nominations in several instances against the united efforts of Townshend and Walpole. Coxe asserts, on the evidence of private papers, that he not only set himself industriously to undermine the cabinet, but even intrigued with the Tories, and made overtures to Bishop Atterbury, the agent of the Pretender. He proposed to the king, it seems, when the ferment of public indignation occasioned by the explosion of the South Sea scheme was at its height, to dissolve the parliament, with the view of bringing in a Tory majority, who under his conduct would quash all inquiry on the subject: the project obtained his majesty's concurrence, but was defeated by the firmness and intrepidity of Walpole. 'The Pretender and the Jacobites certainly at this time,' Coxe adds, 'entertained the most sanguine hopes. Sunderland became a great favourite with them and the Tories, his health was constantly drank by them, and they affected to be secure of attaining, by his means, the accomplishment of their wishes.' There are some strong assertions by Pope as to Sunderland's dealings with the Pretender, both at this and at an earlier period, in Spence's 'Anecdotes,' p. 313. It also appears that he had contrived a plot for the political annihilation of Walpole by persuading the king to offer to make him postmaster-general for life, with the view that if Walpole accepted the office, it would take him out of parliament, or, if he refused it, that he would give offence to his majesty. The king however, when he found that Walpole had never expressed any desire for the place, nor was even acquainted with Sunderland's proposal, refused to allow the offer to be made to him. Sunderland, nevertheless, by persevering, or shifting his mode of attack, might possibly have succeeded ere long in effecting the downfall of his rival; but in the midst of his intrigues he was suddenly arrested by death, on the 19th of April, 1722, being as yet only in the forty-seventh year of his age. He had been thrice married: first, in 1695, to the Lady Arabella Cavendish, daughter of Henry, duke of Newcastle, by whom he had a daughter; secondly, in or before 1702, to the Lady Anne Churchill, second daughter of the duke of Marlborough, by whom he had three sons, and who died 15th April, 1716; thirdly, to Judith, daughter of Benjamin Tichbourne, Esq. (a younger brother of Viscount Tichbourne, in Ireland), by whom, according to some of the peerages, he had no issue, but who is stated in other works of the kind to have borne him a son, who died three days after himself, a daughter who died in infancy, and a second son, which came into the world five months after his death, and died at six months old. Of his three sons by his second wife, Robert, the eldest, succeeded to the earldom, and died unmarried, 27th November, 1729; Charles, the second, became earl of Sunderland on the death of his elder brother and on the death of his aunt, in 1733, became duke of Marl

borough; and John, the youngest, who then succeeded to the family estates, was the father of the first Earl Spencer.

Lord Sunderland, who associated much with the wits and literary men of his day, was one of the members of the famous Kit-Kat Club, and was also one of the set of noblemen who, about the beginning of the last century, used to make a weekly perambulation among the old book-shops in the metropolis in search of early-printed books, scarce pamphlets, manuscripts, and other rarities and curiosities of literature. To this fashion of collecting early literature, which then prevailed, we are undoubtedly indebted for the preservation of many things of more or less interest or value; and the great libraries of Althorpe, Devonshire House, Blenheim, and the Harleian collection of manuscripts, probably acquired in this way many of what are now accounted their most precious articles.

SUNDGAU, a subdivision of the province of Alsace [ALSACE], comprehending the southern part, and having Béfort, Mulhausen or Mühlhausen, Altkirch, Cernay, and Thann for its chief towns: it was a dependency of the bishopric of Basel, or Bâle, and was held by the archdukes of Austria. It was ceded to France by the treaty of Münster, A.D. 1648, and is now included in the department of Haut Rhin. [RHIN, HAUT.]

SUNDSWALL. [ANGERMANLAND.]

SUNNAH. This is the name given by the Mohammedans to the traditionary portion of their law; which was not, like the Korân, committed to writing by Mohammed, but preserved from his lips by his immediate disciples, or founded on the authority of his actions. It holds in Mohammedan theology the same place as the Mishna in the Jewish doctrine, and the names agree in their derivation. The orthodox Mohammedans call themselves Sunnites, in distinction to the various sects which are comprehended under the term Shiites, whose distinguishing characteristic is that they recognise as lawful khalifs Ali and his descendants. The Turks as a nation are Sunnites, and the Persians Shiites. Shiah, from which this latter name is derived, signifies a party or troop.

SUPERFICIAL DEPOSITS. [SURFACE OF THE EARTH.]

SUPERFICIES, the Latin form of the word surface, used in the sense of surface, and sometimes of area. The quantity of an area is called its superficial content, as distinguished from linear content or length, and solid content or bulk.

SUPERIOR, LAKE. [CANADA; MISSISSIPPI, River.]

SUPERSE'DEAS, in law, the name of a writ used for the purpose of superseding proceedings in an action (Tidd's *Practice*; Archbold's *Practice*): in bankruptcy it is the writ used for the purpose of superseding the fiat. It is obtained on application by petition to the court of bankruptcy, and is granted on the ground that the fiat is invalid in point of law, has not been duly prosecuted, &c. [BANKRUPTCY.] (Deacon's *Law of Bankruptcy*; Eden's *Bankruptcy Law*.)

Supersedeas also in its more general sense is used to express that which supersedes legal proceedings, although no writ of supersedeas may have been used for that purpose. Thus if a writ of certiorari be delivered to an inferior court for the purpose of removing a record to a superior court, the writ of certiorari is said to be a supersedeas of the proceedings before the inferior court.

SUPPLEMENT (Trigonometry). The defect of an angle from two right angles. Also chords or arcs of a circle or other curve which have a common extremity, and together subtend an angle of two right angles at the centre, are sometimes called supplemental chords or arcs.

SUPPLY. [PARLIAMENT, IMPERIAL, vol. xvii., p. 271.]

SUPPURATION. [ABSCESS; INFLAMMATION.]

SUPRALAPSARIANS. In the discussions of the doctrines of predestination and election, which arose out of the teaching of the school of theologians at Geneva, two different views came to be taken by the Calvinistic party. Some held that all the occurrences which take place on the earth have been from eternity the subject of a special decree of God: that God decreed to create man solely for his own glory, and, to display his glory in the eternal happiness of some and the damnation of others: that this decree respected not merely the end, but all the means, direct or indirect, by which that end was to be wrought out; and that sin, the fall of man, and the introduction of evil into the world, were decreed by God to happen as necessary means to the end proposed, and God therefore so constituted man, and placed him in such circumstances that he could not but fall. The persons who held these views were called *Supralapsarians* (*supra lapsum*), because, according to their system, the decrees of God respecting the salvation of some men and the rejection of others were in no sense consequent or dependent upon the foreseen fall of man, which itself (on the contrary) took place in consequence of a divine decree.

The other party were called *Infralapsarians*. They considered the decrees of God for fixing the eternal state of man as equally eternal and unchangeable, but they maintained that God did not create man in order that he might fall, but left him free to act for himself; and, though foreseeing that he would fall, did not interfere to prevent him, but decreed that the consequences of this foreseen fall should result in increased glory to himself, and the eternal happiness of the greater part of men.

Beza, Gomar, and Voetius were of the Supralapsarian party.

The synod of Dort adopted the views of the Infralapsarians. 'Modern Calvinists,' generally, go no farther than Infralapsarianism, and often not so far.

(Mosheim's *Eccles. Hist.*, cent. xvii., sec. ii., pt. ii.: c. ii. s. 10-12; and the principal works on systematic theology.)

SUPREMACY is a term used to designate supreme ecclesiastical authority; and is either papal or regal. Papal supremacy is the authority, legislative, judicial, and executive, exercised until nearly the middle of the sixteenth century by the pope over the churches of England, Scotland, and Ireland, as branches and integral parts of the Western or Latin church, and which continues to be exercised *de facto* over that portion of the inhabitants of those countries who are in communion with the Church of Rome. The extent of the legislative authority of the pope was never exactly defined. Whilst it was regarded as nearly absolute at Rome and at Madrid, it was, at Venice, and still more at Paris, sought to be reduced within very narrow limits.

The papal supremacy was abolished by the legislatures of the three kingdoms in the sixteenth century. In order to ensure acquiescence in that abolition, particularly on the part of persons holding offices in England and Ireland, an oath has been required to be taken, which is generally called the oath of supremacy, a designation calculated to mislead, it being in fact an oath of *non*-supremacy rather than of supremacy; since, though in its second branch it negatives the supremacy of the pope, it is silent as to any supremacy in the king. This oath is therefore taken without scruple by persons who are not Roman Catholics, whether members of the Anglican church or not. The form of the oath, as established in England by 1 Wm. & Mary, c. 8, is as follows:—'I, A. B, do swear that I do from my heart abhor, detest, and abjure, as impious and heretical, that damnable doctrine and position, that princes excommunicated or deprived by the pope, or any authority of the see of Rome, may be deposed or murdered by their subjects, or any other whatsoever. And I do declare that no foreign prince, person, prelate, state, or potentate hath or ought to have any jurisdiction, power, superiority, pre-eminence, or authority, ecclesiastical or spiritual, within this realm. So help me God.' Under this, and many former statutes, all subjects were bound to take the oath of supremacy when tendered; but by the 31 Geo. III., c. 32, s. 18, no person, since the 24th June, 1791, is liable to be summoned to take the oath of supremacy, or prosecuted for not obeying such summons; and Roman Catholics, upon taking the oath introduced by that Act, s. 1, in which the *civil* and *temporal* authority of the pope are abjured, may hold office without taking the oath of supremacy; which, as it now no longer operates to harass Roman Catholics, or to exclude them from office, is become almost an unmeaning form.

Regal supremacy is not legislative, but judicial and executive only. Henry VIII. was first acknowledged as supreme head of the church by the clergy in 1528. This supremacy was confirmed by parliament in 1534, when, by the statute of 26 Hen. VIII., c. i., it was enacted 'that the king our sovereign lord, his heirs and successors, kings of this realm, shall be taken, accepted, and reputed the only supreme head in earth of the Church of England, and shall have and enjoy, annexed to the imperial crown of this realm, as well the style and title thereof, as all honours, dignities, pro-eminencies, jurisdictions, privileges, authorities, immu-

nities, profits, and commodities to the said dignity of supreme head of the same church belonging and appertaining; and shall have power from time to time to visit, repress, redress, reform, order, correct, restrain, and amend all such errors, heresies, abuses, offences, contempts, and enormities, whatsoever they be, which, by any manner of spiritual authority or jurisdiction, may lawfully be reformed, repressed, ordered, redressed, corrected, restrained, or amended, most to the pleasure of Almighty God, the increase of virtue in Christ's religion, and for the conservation of the peace, unity, and tranquillity of this realm; any usage, custom, foreign laws, foreign authority, prescription, or any other thing to the contrary notwithstanding.'

Dr. Burn observes, 'that after the abolition of the papal power there was no branch of sovereignty with which the princes of this realm, for above a century after the Reformation, were more delighted than that of being the supreme head of the church, imagining (as it seemeth) that all that power which the pope claimed and exercised (so far as he was able) was by the statutes abrogating the papal authority annexed to the imperial crown of this realm, not attending to the necessary distinction that it was not that exorbitant lawless power which the pope usurped that was thereby become vested in them, but only that the antient legal authority and jurisdiction of the kings of England in matters ecclesiastical, which the pope had endeavoured to wrest out of their hands, was re-asserted and vindicated. The pope arrogated to himself a jurisdiction superior not only to his own canon law, but to the municipal laws of kingdoms. And those princes of this realm above mentioned seem to have considered themselves plainly as popes in their own dominions. Hence one reason why a reformation of the ecclesiastical laws was never effected seemeth to have been because it conduced more to the advancement of the supremacy to retain the church in an unsettled state, and consequently more dependent on the sovereign will of the prince.' (Burn's *Ecclesiastical Law*, tit. 'Supremacy.')

Regal supremacy over the church is not recognised by the established Presbyterian Church of Scotland, which boasts that it has no head upon earth. Notwithstanding this bold assertion, the king possesses a controlling power over the acts of the General Assembly of the Church of Scotland even *in spiritualibus*, though since the accession of the house of Brunswick it has been seldom if ever exercised.

SUR, or SOUR. [TYRE.]

SURAT, or, as the natives pronounce it, *Soorut* ('beauty'), a large city on the western coast of Hindustan, in the presidency of Bombay and province of Gujerat, stands on the south bank of the Taptee, in 21° 12′ N. lat. and 72° 50′ E. long.: the river falls into the Gulf of Cambay about 18 miles west from the city. Surat is about 120 miles north from Bombay, direct distance: it is situated in a fertile country, with woody hills, long sheltered lanes, and patches of dense jungle; and is a favourite hunting district, wild hogs and other game being abundant. There are numerous villages and farms in the neighbourhood.

The city of Surat is in the form of a semicircle; the Taptee is the chord, near the centre of which is a citadel or small fortified castle. The city is surrounded by a wall about six miles in circuit, in good repair, with semicircular bastions, and with battlements. Milburn (*Oriental Commerce*) and others speak of two walls, one round the city and another round the suburbs, the outer wall being twelve miles in circuit, and a mile distant from the inner wall; but as bishop Heber, who was there in 1825, and Mrs. Postans, who visited it in 1838, only mention one wall, it is to be presumed that the wall round the suburbs has been taken down. The citadel is garrisoned by a few sepoys and European artillerymen.

Surat, though a large city, is by no means a handsome one. The streets are narrow, winding, unpaved, in the wet season muddy, and in the dry season dusty. The houses are generally high, and are mostly constructed of a framework of timber (often bamboos) filled up with bricks or sun-dried mud; most of the upper stories project over the lower ones. The houses however of some of the principal merchants are of stone, and are large and well-built; but there are no public buildings worthy of notice as specimens of architecture, and indeed the only structure which has much of interest attached to it is the hospital for aged and diseased animals: it occupies a large piece of ground, surrounded by high walls, and is divided into compartments or wards, with every arrangement requisite for the comfort of the different classes of animals, as horses, oxen, sheep, goats, &c. It has been said that offensive and noxious vermin were kept, but Mrs. Postans denies that this was the case in 1838. It is an establishment founded by the Jains, and is richly endowed by them. The residence of the nawâb is modern, but is not at all striking. There is a neat English church, which was consecrated by bishop Heber in 1825. A large and picturesque burying-ground, outside the city, contains numerous tombs of former servants of the East India Company. These tombs are constructed in the Mohammedan style of architecture, some of them being 150 or 200 years old; that of Sir George Oxenden, for size and solidity, is worthy of one of the founders of the English empire in India.

The population of Surat was estimated, in 1796, when its prosperity had confessedly declined, at 800,000, which was probably too much, but it was perhaps not less than 600,000. It is now very much reduced, the greatest part of its commerce having been transferred to Bombay. The inhabitants at present probably do not exceed 150,000, perhaps not 100,000. They consist of Hindoos, who are mostly Jains, of Mohammedans, many of whom are Boras, of Parsees, and of Armenians, Jews, and various other races, besides Europeans. The Parsees and the Boras are the most flourishing part of the population. The Parsees are of Persian origin, followers of Zoroaster, and of course fire-worshippers, who, when driven out of Persia by the Mohammedans, found an asylum at Surat, where they have continued ever since. Heber thought that half the houses in the city belonged to the Parsees: the Boras, he says, carried on a lucrative trade as banians and money-lenders. There are also great numbers of religious mendicants in this city and its neighbourhood, Fakeers, Yogies, and Gosaens, who enforce charity from the superstition both of Hindoos and Mohammedans.

Surat is the station of a British military force: it is also the seat of the supreme court of justice for the whole presidency of Bombay, of a circuit court, and of a board of customs with a collector. The English society is numerous, and of the best kind.

The Taptee at Surat is a wide river: but the navigation is dangerous, from shifting sand-banks, even to boats; and large vessels are prevented from entering it by a bar, and therefore anchor in the Surat Roads, or Swally Roads, as they are commonly called, from the small sea-port of Swally, at the mouth of the river, where the ships discharge and take in their cargoes. The boats which navigate the river are generally of 30 and 40 tons, half-decked, with two masts and two large latteen-sails. The river opposite the city is brackish: water for domestic purposes is raised by oxen from wells, and there are also large tanks to collect the rain.

The imports to Surat are chiefly from Arabia, Bombay, and Brazil, and consist of grain and other articles of food, piece-goods, raw materials to be worked up into manufactures, and bullion. The exports are mostly manufactures of Surat and the neighbouring districts, raw cotton, and a few other articles of native produce. The vessels are chiefly English, Arabian, and Portuguese.

The history of Surat is eventful and interesting. It is a place of such antiquity as to be mentioned in the antient Sanscrit poem 'The Râmâyana.' After the conquest of Hindustan by the Mohammedans, it was the chief port at which they embarked on their pilgrimage to Mecca; and when the Europeans first discovered the passage by the Cape of Good Hope, was the greatest place of maritime commerce on the continent of India, being in immediate communication with the richest provinces in the Mogul empire, and conveniently situated for trading not only with the western coast of that continent, but with the gulfs of Persia and Arabia. The Portuguese were the first Europeans that reached the western coast of India by sea: after establishing themselves at Calicut, Goa, and Damaun, they began to trade with Surat about 1561. In 1603 Mr. Mildenhall, a London merchant, reached Agra, and in 1606 obtained an ample grant of commercial privileges by a firmaun from the emperor Jehangbir. In 1610 Sir Henry Middleton, on proceeding to Surat, found some Portuguese ships ready to oppose him, and was therefore obliged to fight for our first trifling trade with the inhabitants of Hindustan; and this was the commencement of a series of actions fought with the Portuguese by Captain Best in 1612 and 1613, and by Captain Downton in 1614, in all of which the English were

successful. The consequence of these successes was, that a factory was established at Surat by treaty with the governor of Ahmedabad, in Dec., 1612, and confirmed by an imperial firmaun in 1613. The Dutch also came to Surat about this time, and became powerful rivals to the English, as well as to the Portuguese: they carried on a thriving trade for about a century. The French were long after the Dutch and English in trading to Surat; and though they had a factory there, they never prospered, and at last abandoned it without paying their debts. In 1615 Sir Thomas Roe landed at Surat, whence he proceeded to the emperor at Agra, and obtained grants for the establishment of factories at Surat, Cambay, and elsewhere. Surat now became the chief station of the East India Company on the west coast of India. In 1635 however a rival association was formed in England, at the head of which was Sir William Courten, one of whose ships seized and plundered two native junks belonging to Surat and Diu. In reprisal the president and council were imprisoned by the Mohammedan governor of Surat (the nawâb), and the property of the factory was confiscated. Though the factory was soon afterwards re-established, the English trade continued in a declining state. In January, 1664, Sevajee, the founder of the Mahratta power, made a predatory attack on Surat. The inhabitants fled into the country, and the nawâb shut himself up in his castle. Sevajee proceeded to plunder the city, and at the same time invested the castle, and demanded the surrender of the factory. Sir George Oxenden was then the chief of the English factory. Sir George's answer to Sevajee's demand was, 'We are here on purpose to maintain the house to the death of the last man, and therefore delay not your coming upon us.' Sir George called in the aid of the ships' crews: they made sorties with such gallantry as to prevent Sevajee from plundering the part of the town in which the English factory was situated, and he soon after retired. The nawâb presented Sir George with a dress of honour, and recommended the interests of the Company to Aurungzebe with such effect, that the emperor, by a firmaun, remitted the customs at Surat to all merchants for one year, and granted a perpetual remission of a part of the duties to the English in particular.

Surat continued to be the chief seat of government under the East India Company till 1686, when it was removed to Bombay. In 1687, the conduct of Sir John Child having exasperated Aurungzebe, the factory at Surat was seized, as well as Bombay and other places; but after making submission, they were restored. Surat was fined 150,000 rupees. The city was afterwards partially pillaged by the Mahrattas more than once, and the nawâb was obliged to pay them an annual tribute. In 1800 the nawâb was compelled by the English to sign a treaty, by which he resigned the government, civil and military, with all its emoluments and powers, to the East India Company, who, on their part, agreed to pay him and his heirs one lac of rupees annually, together with one-fifth of the surplus annual revenue, after deducting all charges. Though a state prisoner, the nawâb of Surat, like his master the emperor of Delhi, is still permitted to retain the forms of state and authority; and we believe the Mogul ensign still waves on the walls of the castle of Surat, in company with the English jack. By the treaty of 1803 the Marhattas were compelled to relinquish all their claims on Surat. Surat has suffered severely by fires; a large part of the city was destroyed by one in 1836; but the houses had been, to a considerable extent, rebuilt when Mrs. Postans was there in 1838.

(Heber's *Narrative of a Journey in the Upper Provinces of India in* 1824 *and* 1825; Mrs. Postans's *India in* 1838; Hamilton's *East India Gazetteer*; Milburn's *Oriental Commerce*; Mill's *History of British India*, by H. H. Wilson; Kerr's *Collection of Voyages and Travels*, vols. vi., vii., and viii.)

SURCHARGE. [TAXATION.]

SURD. This word has been used to signify an IRRATIONAL arithmetical or algebraical quantity since the time of the introduction of algebra into Europe; though why any term formed from *surdus* was used in such a sense is not known; perhaps it was the supposed translation of an Arabic term. In the article just cited we have said as much as is necessary on the subject. We will only add that the second volume of Cossali's History of Algebra contains an account of the tenth book of Euclid, with reference to the use made of it by the earlier algebraists.

SURDITES. [DEAFNESS.]

SURE'NA. [CRASSUS.]

SURETY. A surety is one who undertakes to be answerable for the acts or non-acts of another, who is called his principal. Such undertaking must be in writing, and it may be either by bond or by simple writing. A contract is not binding in law, unless made upon some sufficient consideration; but in the case of a bond this consideration is inferred from the circumstances of deliberation incident to its execution as a deed. When the undertaking is not by bond, it is necessary that the consideration should appear upon the face of the written instrument, or be necessarily implied from the terms of it, and that the instrument should be signed by the party who becomes the surety. The instrument however may consist of several writings, if they are so connected by reference to each other that they can be considered as incorporated. The instrument by which the surety becomes bound, when it has reference to civil matters, is generally called a guarantee, and ordinarily consists of an undertaking to become answerable for the payment of goods furnished to the principal, or for his integrity, skill, attention, and other like matters. In such cases the consideration expressed would probably be the furnishing of the goods to the principal, or his employment by the party guaranteed. In the construction of guarantees the same rule of law prevails as in the case of all written instruments,—that they shall be understood in the sense most unfavourable to the party making them which the words will reasonably bear. The application of the rule is very frequent in cases of guarantee where the question arises whether or not the guarantee is what is called a subsisting guarantee. Thus where the surety undertakes to be answerable to the amount of 100*l.* for goods supplied to his principal, this may mean that he will be answerable for the first 100*l.* worth, and cease to be answerable for any goods supplied afterwards; or, that he will continue to be answerable to the amount of 100*l.* for any indefinite period during which goods may be supplied, although the principal has paid for the first 100*l.* worth. The latter kind of guarantee is called a subsisting guarantee. 'If a party,' as Lord Ellenborough says, in deciding upon a case of this kind, 'means to be surety only for a single dealing, he should take care to say so.' Observations of a similar character may be made as to the application of payments by the principal. If a party who becomes surety for the payment of a particular debt means to insist upon the application of the first money afterwards paid by his principal to the discharge of that debt, he should take care that such intention on his part is evident, either from the words of his undertaking or from the course of dealing between his principal and the guarantee. 'The general rule,' as the same learned judge has stated, is, 'that where nothing is directed as to the application of the money, the party who receives it may apply it.' Thus, if the principal was indebted to the guaranteed before the guarantee was given, or has become indebted to him afterwards for other debts than those for which the surety intended to make himself liable, the guaranteed may, if not restricted by the guarantee or the circumstances of the transaction, apply money paid him by the principal to the discharge of these other debts, and still hold the surety liable for the payment of the debt which he has guaranteed.

The circumstances connected with the relative position of the guaranteed and the principal are considered as embodied in the contract between the guaranteed and the surety, and as forming part of that upon which the undertaking of the latter is founded. If therefore these are substantially varied, so as to increase the risk of the guaranteed, or to destroy or suspend his remedy against the principal, the surety is thereby discharged. Thus, if the guaranteed has, at the time the guarantee is given, a lien upon property of the principal in his hands, which he afterwards parts with; or if he extends the time of credit, or after commencing an action against the principal gives him time, the surety will be released. But the variation of circumstances must be substantial; a change which does not operate so as to increase the risk or lessen the remedy will not have such an effect. Neither can the surety discharge himself by a mere request or caution to the guaranteed to abstain from trusting the principal, or to watch his acts, &c. Nevertheless it is the duty, and perhaps an implied undertaking on the part of the guaranteed, against the consequences of the neglect of which a court of equity might relieve the surety,

to employ a reasonable degree of prudence and attention in intrusting his goods, or inspecting and checking the accounts of his clerks or servants. In some cases also a court of equity has interfered to compel the guaranteed to take steps to recover the debt due from the principal, where he has been guilty of gross negligence in abstaining from doing so. It is a general rule that the surety is entitled to the benefit of all the securities which the guaranteed has against the principal.

If the guaranteed compounds with the surety, he does not thereby discharge the principal.

In case of the principal becoming bankrupt, the surety may prove for the amount of the debt owing to the guaranteed; or if the debt has been otherwise proved, the surety may receive the dividends towards the amount of his responsibility to the guaranteed.

With respect to the rights of the surety against the principal, Mr. Justice Buller has distinctly laid down the law, 'wherever a person gives a security by way of indemnity for another, and pays the money, the law raises an assumpsit,' that is, implies a promise on the part of the principal to repay to the surety all the money that he has expended on his behalf, and this money may be recovered in an action against the principal for money paid to his use. But in no case is the surety entitled to more than an indemnity from his principal. Thus, if the guaranteed is content with a less sum from the surety, instead of exacting the full amount for which he is liable, the principal will be bound to repay to the surety the less sum only. If the surety has himself taken a bond or other security from the principal, he relinquishes his right to bring an action upon the promise implied in law, and must have recourse to an action upon his security. The court of chancery will interfere to give the surety relief out of any funds of the principal which he cannot reach at common law.

Where more persons than one become sureties for the same principal, they are called co-sureties. If one of these has paid the whole of the debt due from the principal, he may recover in an action of assumpsit from his co-sureties the amounts for which they were respectively liable. A court of equity will also interfere to regulate the proportions partly due from each. And in case any of them are unable to pay from insolvency, &c., it will compel the others to contribute proportionally the amount for which the defaulters were liable. The law is the same as to co-sureties, whether all have been created by the same instrument in writing, or each one by a distinct instrument.

(Fell, *On Guarantees; Mayhew* v. *Crickett*, 2 Swanston, 185.)

SURETY OF THE PEACE 'is the acknowledging of a recognizance or bond to the king, taken by a competent judge of record for keeping the peace.' Magistrates have the power to take such recognizances, which are generally done by the party acknowledging (*recognizing*, and hence the term *recognizance*) that he is indebted in a bond to the king to a certain amount, the condition of which bond is, that he or the party for whom he becomes bound shall keep the peace during a term named in the condition. Such recognizance may be obtained by any party from another on application to a magistrate, and stating on oath that he has just cause to fear that such other 'will burn his house, or do him a corporal hurt, as by killing or beating him, or that he will procure others to do him such mischief.' Upon such application being made to the magistrate, it is his duty to summon the party before him and cause him to enter, either alone or with others, into such recognizances as he thinks the case demands. The fear must be of a present or future danger: no recognizances are demandable on the ground of a past offence. Upon the neglect or refusal of the party so summoned to enter into the recognizances demanded, he may be committed to prison by the magistrate for a specified period, unless he sooner complies. If the recognizance is forfeited by a breach of the condition, it may be removed into one of the superior courts and there proceeded upon.

Sureties also may be similarly required for the good behaviour of parties who have been guilty of conduct tending to a breach of the peace, abusing those in the administration of justice, &c.

(Burn's *Justice*, tit. 'Surety of the Peace.')

SURF. [SEA.]

SURFACE, SURFACES, THEORY OF. For the mere definition of surface, see SOLID, &c. We are here to speak of that branch of algebraic geometry which considers the generation and properties of curve surfaces following an assigned law.

If three planes, each at right angles to the other two, be taken as the planes of CO-ORDINATES, the position of any point is determined as soon as its co-ordinates, or distances from the three planes, are given in sign and magnitude. If the co-ordinates of a point be x, y, z, and if between these one equation exists, $\phi(x, y, z) = 0$, any point may be chosen in the plane of x and y, by means of given values of x and y, and the corresponding value or values of z may be found from the equation. The locus of all the points whose position can be ascertained by determining one of the co-ordinates from this equation, the other two being taken at pleasure, is a surface of which $\phi(x, y, z) = 0$ is called the equation, and the modes of proceeding are pointed out in all works on algebraic geometry. The applications of the differential calculus depend on the principles explained in TANGENT: the practical use of the whole method depends mostly on descriptive geometry, whether formally known under that name or not.

Surfaces are distinguished algebraically by the nature and order of their equations. Thus we have surfaces of the first order, in which the equation is of the first degree (this class contains the plane only); surfaces of the second order, which will be classified in the next article; and so on.

Surfaces are also distinguished by their mode of generation, and some of the principal cases are as follows:—

1. *Cylindrical surfaces* are generated by a straight line infinitely produced in both directions, which moves so as always to be parallel to a given line, and to have one of its points on a given curve.

2. *Conical surfaces* are generated by a straight line infinitely produced in both directions, which always passes through a given point or vertex, and has one point in a given curve. The common CYLINDER and CONE would be described in this science as a *right circular cylinder* and a *right circular cone*. The cylindrical surfaces themselves are only an extreme case of the conical ones, being what the latter become when the vertex is removed to an infinite distance.

3. *Surfaces of revolution* are generated by the rotation of a curve about an axis, relatively to which it always retains one position. The common cone and cylinder, the SPHERE, and others of the greatest practical use, are contained in this class.

4. *Tubular surfaces* are generated by a circle of given radius, which moves with its centre on a given curve, and its plane at right angles to the tangent of that curve. When the given curve is a circle, the tubular surface is a common ring.

5. *Ruled surfaces* (the *surfaces réglées* of the French writers) are those which are described by the motion of a straight line, which neither remains parallel to a given line nor always passes through a given point. This includes, among many others, the whole class of *conoidal surfaces*, made by a straight line which moves parallel to a given plane, and always passes through a straight line perpendicular to that place and a given curve. The surface of a spiral staircase, as it would be if there were no steps but only a gradual ascent, is an instance.

6. *Developable surfaces* are those which can be unwrapped on a plane without any doubling of parts over one another, or separation; that is, without being rumpled or torn. The only familiar instances are the cylinder and cone.

SURFACES OF THE SECOND DEGREE. This name is given to all those surfaces of which the equation is of the second degree, or can be made a case of

$$ax^2 + by^2 + cz^2 + 2a'yz + 2b'zx + 2c'xy$$
$$+ 2a''x + 2b''y + 2c''z + f = 0,$$

to which form any equation of the second degree between two variables may be reduced. These surfaces hold the same place among surfaces which is held by curves of the second degree, or conic sections, among curves; and every section made by a plane with any surface of the second degree must be a curve of the second degree. The following article is intended entirely for reference, as the books which treat on the subject hardly ever give the complete tests for the separation of the different cases from each other.

1. The preceding equation may be wholly impossible, or incapable of being satisfied by any values of x, y, and z. This happens when the left-hand side can be resolved into

the sum of any number of squares which cannot vanish simultaneously.

2. It may represent only one single point. In this case the left-hand side can be resolved into the sum of three squares, which vanish simultaneously for one set of values of x, y, and z.

3. The equation may belong to a single straight line. In this case the left-hand side can be resolved into the sum of two squares.

4. The two last cases have a particular case which is algebraically very distinguishable from the rest, though it can only be geometrically represented, by saying that the point or line is at an infinite distance from the origin.

5. The equation may belong to a single plane. In this case the left-hand side is a perfect square.

6. Or to a pair of planes, either parallel or intersecting. The left-hand side can then be resolved into two different factors of the first degree.

In the preceding cases there is no other surface than can be represented by one or several equations of the first degree. We now come to the cases in which new surfaces, not plane, are generated. But we may first observe that the left-hand side of the equation has a property much resembling a celebrated one of integer numbers. If it be the sum of any number of squares exceeding four, it may be reduced to the sum of four squares at most.

7. The equation may belong to a cone, having for its base any one of the conic sections. But in every case the same cone may be described by a circle only; that is, every cone of the second order is a circular cone, right or oblique. In this case the first side of the equation takes the form $P^2+Q^2-R^2$, or $P^2-Q^2-R^2$, P, Q, and R being expressions of the first degree, of the form $Ax+By+Cz+E$.

8. The equation may belong to a cylinder having for its base any conic section. But the elliptic, parabolic, and hyperbolic cylinders are perfectly distinct. In this case the first side of the equation can be reduced to the form P^2+mQ^2+nQ, P and Q being expressions of the first degree, and m and n constants.

9. The equation may belong to an *ellipsoid*, a *single hyperboloid*, a *double hyperboloid*, an *elliptic paraboloid*, or an *hyperbolic paraboloid*. These five are the distinct surfaces of the second degree, answering to the three distinct curves of the second degree, namely, the ellipsoid to the ellipse, the two hyperboloids to the hyperbola, and the two paraboloids to the parabola. They will presently be further described; in the mean time the forms to which the left-hand side of the equation may be reduced in these several cases are—

$$\begin{array}{rl}\text{Ellipsoid} & P^2+Q^2+R^2-m^2.\\ \text{Single Hyperboloid} & P^2+Q^2-R^2-m^2.\\ \text{Double Hyperboloid} & P^2-Q^2-R^2-m^2.\\ \text{Elliptic Paraboloid} & P^2+Q^2+mR.\\ \text{Hyperbolic Paraboloid} & P^2-Q^2+mR.\end{array}$$

The conditions under which the several cases are produced are exhibited in the following table. Let

$$V_1=a+b+c$$
$$V_2=bc+ca+ab-a'^2-b'^2-c'^2$$
$$V_3=abc+2a'b'c'-aa'^2-bb'^2-cc'^2$$
$$V_4=(bc-a'^2)a''^2+(ca-b'^2)b''^2+(ab-c'^2)c''^2$$
$$+2(b'c'-aa')b''c''+2(c'a'-bb')c''a''+2(a'b'-cc')a''b''$$
$$W=-\frac{V_4}{V_3}+f.$$

When $V_3=0$, V_4 is a perfect square: if V_4 also $=0$, the three expressions

$$\frac{ba''^2-2c'a''b''+ab''^2}{ab-c'^2},\ \frac{ac''^2-2b'c''a''+ca''^2}{ca-b'^2},$$
$$\frac{cb''^2-2a'b''c''+bc''^2}{bc-a'^2}$$

are all equal. Let either of them, with its sign changed, and increased by f, be called W′. Again, when any three of the six quantities,

$$bc-a'^2,\quad ca-b'^2,\quad ab-c'^2$$
$$b'c'-aa',\ c'a'-bb',\ a'b'-cc'$$

vanish, the other three also vanish. Let these vanish, and also let a'', b'', c'' be in the proportion of a, c', b', or of c', b, a', or of b', a', c. When this happens, the three following,

$$\frac{a''^2}{a},\ \frac{b''^2}{b},\ \frac{c''^2}{c}$$

are equal: let either, with its sign changed, and increased by f, be called W″. The table is then as follows, in which p means either of the signs + or −, and n means the other; and a supposition put in parentheses means that it is a necessary consequence of what precedes, or is not independent.

W	V_3	W′	V_2	W″	V_1	Surface.
p	p		+		p	Impossible.
p	n		+		n	Ellipsoid.
p	p		+		n	Single Hyperboloid.
p	p		−			do. do.
p	n		+		p	Double Hyperboloid.
p	n		−			do. do.
∞	(0)		+			Elliptic Paraboloid.
∞	(0)		−			Hyperbolic Paraboloid.
0	p		+		p	Point.
0	p		+		n	Cone.
0	p		−			do.
$\frac{0}{0}$	(0)	p	+		p	Impossible.
		p	+		n	Elliptic Cylinder.
			−			Hyperbolic Cylinder.
		∞	(0)			Parabolic Cylinder.
		0	+			Straight Line.
		0	−			Intersecting Planes.
		$\frac{0}{0}$	(0)	p	p	Impossible.
				p	n	Parallel Planes.
				0		Single Plane.
				∞		

For example, it is the condition of an ellipsoid that W and V_3 should be finite with different signs, that V_2 should be positive, and V_1 of the same sign as V_3: it is the condition of intersecting planes that W should have the form $0\div 0$, or that V_4 and V_3 should both vanish; that W′ should also vanish; and that V_2 should be negative. It is the condition of a single hyperboloid, if V_2 be positive, that W and V_3 should both differ in sign from V_1: but if V_2 be negative, it is enough that W and V_3 should have the same sign. All that precedes is equally true, whether the co-ordinates be oblique or rectangular; but the following is only true for rectangular co-ordinates: if the surface be a surface of revolution, it is necessary that

$$\frac{b'c'-aa'}{a'}=\frac{c'a'-bb'}{b'}=\frac{a'b'-cc'}{c'}.$$

The forms of the ellipsoid and the two hyperboloids may be best conceived by means of the particular cases in which they are surfaces of revolution. Let an ellipse revolve about one of its axes, and let all the circular sections be flattened into ellipses: the result will be an ellipsoid, derived from its particular case, the spheroid. Let an hyperbola revolve about its minor axis; the two branches will generate only one branch of a surface: let the circular sections be flattened into ellipses, and the result is the single hyperboloid. Let the hyperbola revolve about its major axis: the two branches will generate two branches of a surface; and if the circular sections be flattened into ellipses, the result is the double hyperboloid. For the elliptic paraboloid, let a parabola revolve about its principal axis, and let the circular sections become ellipses. The hyperbolic paraboloid has no surface of revolution among its cases, but its form may be conceived as follows:—Let two parabolas have a common vertex, and let their planes be at right angles to one another, being turned contrary ways. Let the one parabola then move over the other, always continuing parallel to its first position, and having its vertex constantly on the other: its arc will then trace out an hyperbolic paraboloid.

The ellipsoid and the two hyperboloids have centres, but neither of the paraboloids has one. The surfaces which have centres possess an infinite number of triple systems of diameters having properties corresponding to those of the conjugate diameters of an ellipse and hyperbola. These we shall not enter further into, but shall proceed to point out how to determine the position of the centre and principal diameters or axes (that is, the system of conjugate diame-

ters, each of which is at right angles to the other two) in either of the surfaces having a centre. Resuming the original equation, and the co-ordinates being supposed rectangular, the co-ordinates of the centre, X, Y, and Z, are thus determined. They are fractions whose denominator is $-V_3$, and whose numerators are

$$(bc-a'^2)a''+(a'b'-cc')b''+(c'a'-bb')c''$$
$$(ca-b'^2)b''+(b'c'-aa')c''+(a'b'-cc')a''$$
$$(ab-c'^2)c''+(c'a'-bb')a''+(b'c'-bb')b'';$$

and if the origin be removed to the centre, the axes retaining their original directions, the equation of the surface becomes

$$ax^2+by^2+cz^2+2a'yz+2b'zx+2c'xy+W=0,$$

where W is the expression already signified by that letter, and will be found to be also $Xa''+Yb''+Zc''+f$.

Let the three principal axes now make angles with the axes of x, y, and z, as follows:—the first, angles whose cosines are α, β, γ; the second, angles whose cosines are α', β', γ'; the third, angles whose cosines are α'', β'', γ''. The equation

$$v^3-V_1v^2+V_2v-V_3=0$$

has always three real roots; let them be A, A′, A″. Then the directions of the principal axes are to be determined from

$$\alpha^2=\frac{bc-a'^2-(b+c)A+A^2}{(A-A')(A-A'')}$$
$$\beta^2=\frac{ca-b'^2-(c+a)A+A^2}{(A-A')(A-A'')}$$
$$\gamma^2=\frac{ab-c'^2-(a+b)A+A^2}{(A-A')(A-A'')}.$$

To find α'^2, &c., interchange A and A′ in the above; and to find α''^2, &c., interchange A and A″. The principal axes being thus determined, the equation to the surface, referred to the principal axes, is

$$Ax^2+A'y^2+A''z^2+W=0,$$

a form which is fully considered in all elementary works on the subject, and from which the principal properties are derived. (*Algebraic Geometry*, in the 'Library of Useful Knowledge.')

For the proofs of the preceding assertions, and their extension to oblique co-ordinates, see a paper 'On the General Equation of Surfaces of the Second Degree,' in the Cambridge Philosophical Transactions, vol. v., part 1. Under the form of considering the surface of the second degree, we have in fact been treating the general properties of the equation of the second degree, with three variables, and have solved various other problems of geometry and mechanics. The principles applied in this solution have been generalized in a paper on 'Linear Transformations,' by Mr. Boole. (*Cambr. Math. Journ.*, vol. iii., p. 1.)

SURFACE OF THE EARTH. Geology, by teaching us to look upon the form and distribution of land and sea, the features of hills and valleys, and the various deposits of peat, silt, gravel, &c., as effects of physical agencies, some of which are no longer in operation upon those areas where once they predominated, confers upon the surface of the earth an interest much greater than that which belongs merely to pictorial combinations, or even to agricultural utility and commercial adaptation. Uniformity, inequality, height, depth, and area, every the least peculiarity of form, whatever is remarkable in any part of the surface of the land or bed of the sea—these are effects of causes which require to be traced out before the problem of the physical history of the globe can be considered as resolved.

Superficial Deposits.—If the stratified and unstratified rocks which compose the skeleton of the earth were laid bare to our view, the aspect of the globe would be far more rugged than it is now. The valleys would in many cases lose their soft and easy curvatures and accordant slopes, in angular fractures and irregular chasms; the mountains and hills would lose those sloping buttress-like banks, composed of fallen materials, which connect the broken ridges above with the level expanse below; a sterner aspect would belong to the now sinuous lines of sea-coast; and an almost general barrenness would overspread the inland surface.

The soil, gravel, clay, peat, and other substances, which by their accumulation mask the features of the interior rocks, constitute a peculiar class of phenomena which have been much, and yet not sufficiently, studied by geologists. It is certain that without a more exact appreciation of the causes which have permitted the aggregation of the 'superficial deposits' already named, our analysis of the processes whereby the earth has been made fit for the residence of man, and adapted to its present uses, must be very imperfect.

Soil is often supposed to be merely the disintegrated parts of the subjacent rocks, and this is sometimes really the case; trap rocks, for example, of which the felspar and the hornblende become decomposed by the atmosphere, yield a soil often remarkable for fertility, and uncontaminated with foreign ingredients. But the soils which cover clays and limestones and sandstones are seldom of this simple origin. The basis of these soils may be generally derived from the subjacent strata, but they usually contain foreign ingredients. The soil on the chalk and limestone hills of England is often sandy, sandstones are covered by loam, and clays overspread with pebbles. The effect of this admixture of foreign substances with the disintegrated parts of the native rock is usually favourable to fertility.

We may often understand the cause of these admixtures by considering the effect of rains and currents of water on the sloping surface of the earth. These effects arrive at a maximum in particular vales and plains, into which many streams enter after flowing over strata of different kinds. In such vales the soil is in fact a mixture of calcareous, argillaceous, and arenaceous parts, and its indigenous plants are correspondingly varied, and include many which are not found growing together on any one of the soils which are here mixed together.

To watery agency, acting under the actual circumstances of physical geography, we may also ascribe many even extensive accumulations of gravel and sand which lie along the sides of valleys and in hollows of hills, or on the slopes of mountains; and it requires sometimes only the postulate, that in particular valleys inundations have formerly reached higher levels than at present, to apply the same explanation to terraces of gravel and sand now considerably above the actual flood-mark, but sloping parallel to the general inclination of the valley.

The beds of old lakes, often consisting of layers of shelly marl, with bones of existing or extinct quadrupeds, the surfaces of silt which lie along the actual and antient æstuaries of rivers, and often conceal buried forests and subterranean peat, present no difficulty as to their origin. For the processes by which peat grows and trees are buried, and marshy land is saved from the sea, and lakes are filled up, are at this day in action. To all such peat or turf moors, subterranean forests, marsh and fen land, drained lake-beds, and sand and gravel, the title of *alluvial deposits* is very commonly given. Generally, they require no supposition of extensive changes of physical geography produced by violent disturbances of nature, but seem to be clearly and perfectly explicable by causes still in action, though perhaps not in the same situations on the earth's surface. But there are other gravels, sands, and clays, to which this explanation cannot be applied without calling in aid great changes of physical geography, or physical processes not seen in daily operation: such as extensive displacement and change of level of land and sea; unexampled floods of water; surprising alterations of climate, or movement of glaciers in situations where now the snow and ice of the coldest winter melt with the first breath of spring. These phenomena were classed under the title of *diluvial deposits*, at a time when their origin was very generally ascribed to violent floods of water, and the title is still retained even by geologists who do not admit this hypothesis.

These diluvial deposits are commonly admitted or assumed to be of older date than those called alluvial, and, taken in a collective sense, they are so, but this is the least important circumstance characteristic of their history. The conditions of their accumulations are remarkable.

1. It is often seen that thick deposits of clay, sand, and pebbles, or large fragments of rock, lie on the very summits of hills (as abundantly on the hills which adjoin the valley of the Thames).

2. Fragments of rocks quite unlike those of the vicinity lie in valleys, on hills (as on the Salève near Geneva), and even on islands (as on Staffa).

3. These fragments are found solitary, or buried in clay, sand, or gravel, and sometimes in enormous abundance, as in Huntingdonshire, near Birmingham, in Holderness, and other parts; and they are such that no stones of like nature occur anywhere in the natural drainage of the country

where the gravel is accumulated, nor within 20, 50, or even 100 miles of the spot.

4. The fragments (often called boulders) appear thus in several cases to have been transported from particular parts of the country, over elevated ground, across the natural valleys and ranges of hills, but yet are, in some cases, distributed in a manner which manifests a decided dependence on some of the greater features of physical geography. Thus the abundantly spread detritus from the Cumberland mountains crosses the island to Tynemouth, and reaches the coast of Yorkshire, but does not cross the Pennine chain of mountains, except at one point (Stainmoor), though it spreads along the western side of it as far south as Manchester and the plains of Cheshire and Staffordshire. In like manner the detritus from the Western Alps has been carried on to the Jura, and lies in a strange manner in all parts of the hollow of the Lake of Geneva, and on the insulated Salève Mountains; yet it has been observed that the lines followed by the boulders are those of the great valleys, so that each great valley has been the direction in which were carried the blocks from the head of that valley.

5. It is observed that often the largest blocks contained in a mass of diluvial detritus lie at the top, resting on the smaller gravel and sand; and that below the whole mass the hard rocks are scratched by parallel distinct small grooves or striæ, marks of the dragging movement to which the stones were subject in their passage.

6. Though in some cases successive deposition can be traced in the parts of a diluvial mass, it is very often seen that the materials are entirely unarranged, mere heaps of stones, and sand or mud; the stones being often indiscriminately stuck in clay, large and small, heavy and light, absolutely without any stratification, such as long suspension in water must certainly have produced.

7. Finally, amidst such confused masses, bones of land quadrupeds, mostly or entirely of extinct species, and even of extinct genera, occur, and locally even in abundance. These are however more common in laminated lacustrine deposits resting upon the diluvial masses, or perhaps covered by them.

It has been thought possible to explain these characteristic phenomena by many local inundations, or one general and overwhelming flood, capable of overcoming many of the lesser inequalities of surface-level, but modified in its course by the larger ranges of mountains and valleys. And as in the northern zones of the world (which have been much investigated in this respect) there is a very frequently observed direction of the boulders to the south or south-east, it has been proposed for consideration whether some great change of the level of land and sea in the circumpolar regions might account for what seems a general fact. But further, as the most abundant deposits of this nature have been drifted from particular chains of mountains, as the Cumbrian group in England, the primary mountains of Norway, the Alps, &c., all which districts have undergone elevation *at some time*, it has been thought that their upward movement may have been the cause of the displacement and transport of the blocks. (Buckland, *Reliquiæ Diluvianæ;* Elie de Beaumont, *Sur les Revolutions du Globe.*)

It has however been proposed to account for the distribution of the boulders by a more gradual action of the waters of the sea. If the region of Cumbrian rocks, for example, and a very large portion of the north of England, were supposed to be raised from the sea, by a continual or intermitting movement, so as to bring successively under the action of the breakers the whole country to the east and south-east of the area now occupied by the Cumberland mountains, this would allow of a continual drifting of the boulders to the east and south, by the continual tendency of the tides and currents of the sea. (Phillips, in *Treatise on Geology, &c.;* Whewell, in Murchison's *Silurian System.*) Floating ice has been represented as adequate to carry off from the shore where it was formed masses of mud and fragments of rocks, and, by melting or turning over, to spread them on the bed of the sea. This sea-bed raised would show the accumulations from such icebergs, often in narrow bands or insulated patches, such as really occur, and have been long celebrated, among the heaps of Norwegian detritus which lie on the sandy plains of North Germany. (Lyell, *Principles of Geology;* Murchison, *Silurian System.*)

Finally, ice in another form has been appealed to for the explanation of diluvial phenomena. The formation of glaciers in mountain valleys is such as to permit of their forward movement down a slope, and their carrying with them in their progress fragments of rocks and heaps of gravel and mud which by any cause fall upon their surface. These heaps of 'moraine' accumulate along the sides and at the lower termination of the glacier, and the arrangement, or rather confused aggregation, of the materials in them resembles very much the diluvial masses. The surface of the rocks below a glacier is scratched, as we have before stated to happen in places where boulders are noticed; and as in the Alps it is certain that glaciers have formerly been extended much farther from the mountain-summits than now they are, it has been conjectured that antiently, in the times coincident with or preceding the diluvial period, they were very much more extended, so as even to have reached from the Alps to the Jura, from the mountains of Norway to those of Bohemia, and from Shap Fells in Westmoreland to the mouth of the Humber. Upon the subsequent contraction of these glaciers, the moraines they had left would experience some changes by the action of water (melted ice), which might then run in lines impossible for watery currents after the ice was fully removed. (Agassiz, *Etudes sur les Glaciers.*)

We do not propose to investigate any of these hypotheses. Geologists have been remarkable for eagerly adopting and as easily abandoning most of them; and others might have been added merely as beacons to be avoided. It may be proper however to point out three things which may be useful to remember in further prosecuting this subject.

1. It must be determined by evidence whether the accumulation to be explained happened on the land at its present level, or on the bed of the sea.

2. It must be determined by evidence what was the probable character of the climate in the countries where diluvial accumulations excite attention.

3. In proposing a general cause, such for example as the movement of glaciers, it must be shown to be adequate to satisfy all the minuter details of the phenomena, and not inconsistent with general limiting conditions established by extensive induction from facts observed in the earth itself, or admitted as parts of general cosmical theory. [GEOLOGY; REFRIGERATION; SUBMARINE FORESTS.]

The determination of the cause of the diluvial accumulations is of the highest importance in geological theory. It is impossible to doubt that to the same cause must be ascribed many considerable modifications of the *preexistent surface* of the land. If, abstracting our attention from the accumulated deposits which conceal the stratified and other rocky masses in the crust of the earth, we look at the *actual form* of its surface, there appears little that is even difficult of explanation by the application of known and real causes. The relative areas of sea and land; the peculiarities of outline of continents and islands; the directions of mountain-ranges, and remarkable vales and plains; the individual features of hills and valleys; the degree in which the land is wasted in some quarters and augmented in others; and the rate of change which may take place in these respects;—all this may be satisfactorily referred to subterranean and submarine disturbances of different periods, to the effects of the sea upon the land when the land was not at its present level above the water, and to the operation of the atmosphere, rains, rivers, and inundations.

From this large field of research we shall select for brief illustration the outlines of land and sea, the directions of high and low ground, and the individual features of hills and valleys. The few examples needed will be drawn from the British Isles, but the explanations are of general application.

Much of the irregularity of outline, on a large scale, of the British Islands depends on the *form* in which the antient bed of the sea was elevated into dry land. Thus the line of the Hebrides, the prominent parts of Caithness, of Aberdeenshire, and of Argyleshire, are on axes of upward movement of the primary strata; while the Great Caledonian Valley, from Fort William to Inverness, and the great basin of the Forth and Clyde, are in axes of depression of the strata. This latter hollow is margined on the south by the great axis of elevation of the Galloway and Lammermuir hills, reappearing beyond the Irish Channel south of Belfast, as the Argyleshire chain is resumed in Donegal. The Isle of Man, the promontory of Lleyn in Caernarvonshire, the east

and west ridges and hollows of the strata which reach the sea in South Wales and North Devon, give to Pembrokeshire, Glamorganshire, and North Devon remarkable and detailed alternations of promontory and bay. The Isle of Wight is formed on an axis of elevation from the Needles to Culver Cliff; while north of it are the axis of depression of the Solent, the axis of elevation of the wealds of Sussex, and the axis of depression of the æstuary of the Thames.

Inland the same ridges and hollows, and others of as great importance, produce continuous chains of hills—the North-western Highlands, the Grampians, the Lammermuir range of hills, the Wicklow mountains, the Snowdon, the Berwyn, and Malvern hills, and multitudes of other narrow tracts of elevated land. Great *faults*, elevating or depressing one portion of a natural district, leave marks of inequality on the surface. Thus the great Pennine faults, ranging from Newcastle to Brampton, and thence to Kirby Lonsdale and Settle, occasion differences of level in the ground of 1000 and 2000 feet for a length of 100 miles.

In all cases, and in every country, it appears that, notwithstanding the operation of later agencies, the main features of the surface of the land are due to the positions in which subterranean movements left the displaced masses of rocks. But the operation of subsequent agencies is distinctly traceable in modifications of these features on the sea-coast, and in the interior of every country.

The surface of the land has been *wasted*, and as the various stony and earthy masses which come to the surface have unequal compactness, and are unequally capable of resisting the chemical and mechanical agencies which originate in the varying heat and moisture of the atmosphere, we find in consequence a multitude of irregularities, both on a large and small scale, directly related to the properties of the rocks. On the sea-coast some parts are known to be wasted (as the coasts of Sheppey, Dunwich, and Bridlington) even rapidly, one or several yards annually on the average; others seem almost unchanged by a thousand years of storm and tempest, as the 'Worm's Head;' and some considerable tracts of new land have been added to the shores of Lincolnshire, along the banks of the Thames, and by the side of the Severn.

The line of coast from the Tyne to the Humber is instructive in this respect. The prominences on the Durham coast, ending with Hartlepool, are guarded by magnesian limestone, and the æstuary of the Tees is excavated in red marl and lias clays. The peak near Robin Hood's Bay, Scarborough Castle Hill, Filey Brig, and Flamborough Head are all promontories of hard rocks; but Robin Hood's Bay, Scarborough Bay, Filey Bay, and Bridlington Bay are all excavated and wasted in clays of the liassic, oolitic, and diluvial periods. The interior of the country shows similar effects on a grander scale. The great vales and plains of England, in parts the least influenced by subterranean disturbances, are by no means the excavated paths of rivers, nor are the great ranges of hills the separating summits between such rivers. The plains and vales are lines of soft and perishable strata, and the crests which divide these vales are ranges of harder rocks. A transverse section of the English strata shows always, both on a large and small scale, this important fact (see *Fig.* 1), and every well-

Fig. 1.

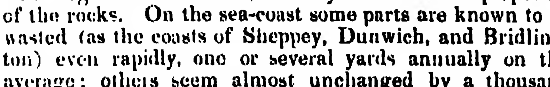


Fig. 1 shows the relatively prominent parts in a line of section across the secondary strata. 1, being chalk; 2, lower green-sand; 3, coralline oolite and calcareous grit; 4, cornbrash; 5, forest marble; 6, great oolite; 7, inferior oolite; 8, marlstone; 9, lias limestone. The intervening hollows are uniformly argillaceous.

shaded topographical map, coloured geologically, demonstrates the extent of its application in explaining the irregularity of surface. The chalk hills, oolitic hills, &c. alternating with vales of clay, in all the southern and eastern parts of England, give to those parts characters far more important than the undulations connected with river channels.

Similarly, hills and valleys, in which rocks of unequal power of resisting watery action appear, show the force and continuity of this action by the prominence of the hard rocks and the excavated surfaces of the softer masses. Thus, in *Fig.* 2, we see on the breast and edges of a hill composed of limestones, sandstones, and shales, the especial prominence of the limestones; and where these cross a

Fig. 2.

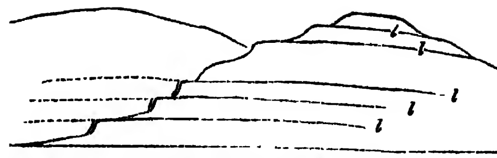


Fig. 2. Aspect of a mountain consisting of carboniferous limestone, shale, and sandstone; the limestone bands (marked *l*) project remarkably, and, where they cross a valley, make waterfalls.

valley, each limestone edge is the place of a waterfall. By studying in such valleys the manner in which the actual stream wastes the rocks, we can easily assure ourselves of the truth of the general explanation offered above. In *Fig.* 3 is a section of a waterfall, showing the edge of limestone

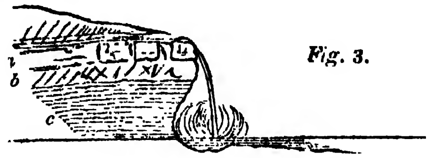


Fig. 3.

Fig. 3. The side view of a waterfall, where the stream falls free of the rock, and causes excavation in the subjacent shales.

(*a*), over which the water falls, and under it a bed of sandstone (*b*) little wasted, but at the bottom a body of shale which has perished by the dampness and spray, and is excavated in a remarkable manner.

Just such an action is observable on similar cliffs by the sea, and in each case the same effect follows: the falling of the hard rock at top from want of support below. Thus the situation of a waterfall is daily displaced, and is moving up the stream—as the Falls of Niagara and Hardrow Force are known to have done. (Lyell, *Principles of Geology*.) Into all these effects of waste on the earth's surface rain enters for something important. Few surfaces of rock are altogether exempt from chemical changes dependent on atmospheric variations; all are more or less liable to perish with rain, frost, and watery movements; and thus the individual features of hills and valleys, the ranges of high and low ground, and the outlines of land and sea, appear to be effects impressed by subterranean movements and fractures of the earth's crust, modified by the action of the sea on materials of unequal resisting power, while they were below, and while they were rising through its waters, and by the subsequent mechanical agencies of rivers, rains, and chemical forces excited by atmospheric variations. [GEOLOGY.]

SURGEONS, COLLEGE OF. The present College of Surgeons of London had its origin in the Company of Barber-Surgeons, which was incorporated by royal charter in the first year of Edward IV. The connection between the practice of barbers and that of surgeons commenced in the custom of employing the former to assist in the use of baths, in the application of ointments, and in various other surgical operations performed by the monks and Jews, who, from the tenth to the twelfth centuries, were almost the only practitioners of the healing art. In 1163 the Council of Tours having prohibited the clergy from undertaking any bloody operation, the practice of surgery fell into the hands of the barbers and the smiths, of whom the former soon became by far the more important class.

By the charter of 1 Edward IV., the barbers practising surgery in London, who had before associated themselves in a company, were legally incorporated as the Company of the Barbers in London, and received authority over all others practising the same arts in and about the metropolis. Their authority extended to the right of examining all instruments and remedies employed, and of bringing actions against whoever practised illegally and ignorantly: and none were allowed to practise who had not been previously admitted and judged competent by the masters of the company.

This charter was several times confirmed by succeeding kings, but in spite of it many persons practised surgery independently of the company, and at length associated themselves as members of a separate body, and called themselves the surgeons of London. In the 3rd year of Henry VIII. it was enacted 'that no person within the city of London, or within seven miles of the same, should take upon him to exercise or occupy as a physician or surgeon, except he be

first examined, approved, and admitted by the bishop of London or by the dean of St. Paul's for the time being calling to him four doctors of physic, and for surgery other expert persons in that faculty.' All who under this act obtained licence to practise were of course equally qualified, whether members of the company of barbers or not; and in the 32nd year of Henry VIII. the members of the latter company, and those who had incorporated themselves as the company of surgeons, were united in one company 'by the name of masters or governors of the mystery and commonalty of barbers and surgeons of London.'

By this act the united body were granted all the privileges of the Barbers' Company. A charter granted by James I. gave the surgeons of the company an exclusive right of practising within three miles of London; and another, granted by Charles I., proposed to exclude every person from practising surgery in or within seven miles of London, unless after an examination by the examiners of the company. The act of the third year of Henry VIII. however was not repealed, and the members of the company were obliged to obtain the testimonials of the ordinaries before they could lawfully practise either within the precincts of London or in the other dioceses of the kingdom

In the 18th year of George II. an act was passed by which the union of the barbers and surgeons was dissolved, and the surgeons were constituted a separate company, having by this time attained to be practitioners of a scientific art, which placed them far in advance of their former compeers. By this act the company of surgeons was granted all the privileges which the previous united company had enjoyed by virtue of 32 Henry VIII., and the letters-patent of Charles I., &c. It therefore virtually repealed the ecclesiastical power of licensing surgeons, and conferred on the members of the company the right of exclusive practice within London and Westminster and seven miles around, and the privilege of practising in every part of the kingdom. But the corporation thus instituted became dissolved or suspended (Willcock, *On the Laws of the Medical Profession*) by the death of the master on the day of election, and their consequent incapacity of electing a successor. Its affairs however were as regularly carried on as if its constitution had not been affected; and in the 40th year of George III. a charter was granted by which it was confirmed in all the privileges which had been conferred upon it by the act of George II.

By this charter the title of the Company was altered from that of the masters, governors, and commonalty of the Art and Science of Surgeons to that of the Royal College of Surgeons in London, which it now bears. It is governed by a council or court of assistants, consisting of twenty-one members, of whom ten compose the court of examiners. Of these ten one is annually elected president, or principal master, and two are annually chosen vice-presidents or governors. By the bye-laws which the council were empowered by the charter to make, the members of the council are to be chosen for life from those members of the College whose practice is confined to surgery, and are to be elected by ballot at a meeting of the council. The rule generally followed, though not necessarily to be observed, is to elect in order of seniority those of the class of members just mentioned who possess a considerable professional reputation and reside in London. The examiners are generally chosen in order of seniority from the members of the council: the presidents and vice-presidents are chosen in rotation from the court of examiners, the president for the current year having been the senior vice-president during the past year.

The members of the College are admitted by diploma after examination before the court of examiners, and their diploma confers upon them the right of practising surgery in any part of the British dominions.

The council of the College have at various times required certain qualifications of age, education, &c. from candidates for examination. The regulations last issued (October, 1841) require candidates—1st, to be not less than twenty-one years old; 2nd, to have been engaged in the acquirement of professional knowledge during not less than four years, six months of which shall have been occupied in the study of practical pharmacy, twelve months by attendance on the practice of physic, and three years on the practice of surgery at a recognised hospital or hospitals in the United Kingdom, three months vacation being allowed in each year; and, 3rd, to have studied anatomy and physiology by attendance on lectures and demonstrations, and by dissections, during three anatomical seasons (each continuing from October to April inclusive), and to have attended two courses of not less than seventy lectures each in surgery, and one course of seventy lectures on each of the following subjects, viz. the practice of physic, materia medica, chemistry, and midwifery with practical instruction. These rules however apply only to candidates who have not previously obtained any medical or surgical diploma. Members and licentiates in surgery of any legally constituted College of Surgeons in the United Kingdom, and graduates in surgery of any university requiring residence to obtain degrees, are admitted for examination on producing their diploma, licence, or degree, together with proofs of being not less than twenty-one years of age, and of having been occupied at least four years in the acquirement of professional knowledge. Graduates in medicine of any legally constituted college or university requiring residence to obtain degrees are admitted for examination on producing, together with their diploma, proof of having completed the anatomical and surgical education required by the foregoing resolutions.

The examinations are conducted *vivâ voce*, or, if the candidate desire it, in writing. The questions are almost exclusively anatomical and surgical; and the examination of each candidate occupies about an hour and a half, during which time he is usually questioned by four of the examiners in succession.

The advantages conferred by the diploma of the College of Surgeons are practically little more than honorary. For although its charter, confirming the privileges given to its members by previous acts and charters, renders it illegal for any one but a member of the College to practise surgery in London or Westminster, or within seven miles thereof, and illegal for any one but a member of the College, or one licensed by the ordinary or vicar-general of his diocese, to practise surgery in any other part of the kingdom, yet the College has never prosecuted any one who has practised without possessing either of these titles. The only real privileges of the members of the College therefore are, that their diploma qualifies them for examination before the army, and navy, and East India Company's medical boards; that they have access to the library, the museum, and the lectures at the College; and that in the majority of cases they alone are eligible to hold surgical appointments in public and charitable institutions.

Nevertheless the diploma of the College of Surgeons is regarded as essential to the respectability of all those medical practitioners in England who do not practise as physicians. The present number of members is rather more than 12,000, and about 600 diplomas are granted annually.

According to the last financial statement (June, 1841), the receipts of the College for the previous year were as follows:—

	£	s.	d.
Court of examiners; fees for diplomas, at 20 guineas each, exclusive of the cost of stamps	12,761	14	0
Rent	37	10	0
Fees on admission to council and court of examiners (20 guineas each) .	105	0	0
Fee on certificate of diploma . .	5	5	0
Incidental, sale of lists, catalogues, &c.	39	13	0
Dividends on investments in government securities, &c. . . .	1,299	4	4
	£14,158	6	4

And the disbursements were as follows:—

College department, including council, court of examiners, auditors, diploma-stamps, collegiate prize, salaries, &c.	6,357	12	7
Museum department, including catalogues, specimens, spirit, salaries, &c.	2,823	5	11
Library department, including the purchase and binding of books, salaries, &c.	778	0	0
Miscellaneous expenses, taxes, rent, &c.	434	6	3
Studentships in anatomy . .	192	7	7
Repairs and alterations . . .	238	19	11
Hunterian oration, lectures, Jacksonian prize, &c.	99	17	0
	£10,924	9	3

The museum of the College consists of the collection made by John Hunter [Hunter, John], which was given in trust by government, who purchased it for 15,000*l.*, and of numerous additions made to it by donations of members and others, and by purchase. The part of it which illustrates physiology is probably the most valuable collection of the kind in Europe. It is open to the members, to the trustees of the Hunterian collection, and to visitors introduced by them on the four first ordinary days in each week; also, in compliance with the deed of trust, to all fellows and licentiates of the Royal College of Physicians in London, to peers and members of parliament, to the great officers of state, and of the royal household and their immediate deputies, to all the dignitaries of the church and of the law, to all general and flag officers, to the members of all the learned and scientific bodies in the United Kingdom, to the members of all the public boards, and to persons introduced personally by them respectively.

One student in anatomy is usually appointed annually, at a salary of 100*l.* per annum. They are chosen after examination by the museum committee. Candidates must be members of the College under twenty-six years of age. Their office is to assist the conservators of the museum in the preparation and dissection of specimens, and in other parts of their duties. At the end of three years' service they are eligible to assistant-surgeoncies in the army, navy, or East India Company's service; one such appointment every third year in each of the three services having been placed at the disposal of the president and council of the College.

Lectures on anatomy, for which 510*l.* were left to the company of barber surgeons by Edward Arris, and 16*l.* per annum by John Gale, are delivered annually by one of the members of the council or some other member selected by them. Twenty-four museum lectures are also, in compliance with the deed of trust, annually delivered by the Hunterian professor, the subjects of which must be illustrated by preparations from the Hunterian collection, and from the other contents of the museum. And an oration in commemoration of John Hunter, or of others who have been distinguished in medical science, is delivered annually on the 14th of February, the anniversary of Hunter's birth.

Abstracts of the several acts and charters relating to the College of Surgeons may be found in Willcock 'On the Laws relating to the Medical Profession,' London, 1830, 8vo., and in Paris and Fonblanque's 'Medical Jurisprudence,' vol. iii. The bye-laws, the list of members, the catalogues of the museum and library, &c., are published by the college.

In the article Anatomy some account is given of the manner in which the study of that science was at that time pursued. The dissection of the human body has since been made the subject of an act of parliament (William IV., 2, 3, c. 75), of which an abstract may be very appropriately placed here.

By this act, which is intituled 'An Act for regulating Schools of Anatomy,' it is enacted that the home secretary of state in Great Britain, and the chief secretary for Ireland, may grant licences to practise anatomy in Great Britain and Ireland respectively to any person lawfully qualified to practise medicine or surgery in any part of the United Kingdom, or to any teacher of anatomy, medicine, or surgery, or to any student attending any school of anatomy (sec. i.). The secretary of state or chief secretary, as the case may be, is to appoint not less than three inspectors of places where anatomy is carried on, who are to continue in office for one year, and may be re-appointed or removed by the secretary (sec. ii.), and whose districts of superintendence are also to be determined by the secretary (sec. iii.).

The inspectors are to make quarterly returns to the secretary of state of all the bodies dissected in their respective districts (sec. iv.), and to inspect, at any time, any place in which anatomy is practised within the same district (sec. v.).

Any executor or other party having lawful possession of any dead body, with which he has not been intrusted for the purpose only of interment, may permit that body to be anatomically examined (*i.e.* dissected), unless the deceased have been known to express, either in writing at any time, or verbally to two witnesses during his last illness, a desire to the contrary, or unless any known relative of the deceased shall require the body to be buried without such examination (sec. vii). If any person, either by writing at any time, or verbally as aforesaid during his last illness, shall direct his body to be examined after death, or nominate any person licensed under this act to make such examination, and if before the burial of the body such direction be made known to the party having lawful possession of it, he shall direct the examination to be made by the person nominated, unless the deceased person's nearest known relative, or any one or more of such person's nearest known relatives, being of kin in the same degree, shall require the body to be interred without such examination.

No body may be removed for anatomical examination from the place where the person died unless forty-eight hours have elapsed from the time of death, nor until after twenty-four hours' notice given after death to the inspector; or if an inspector be not appointed, to some physician, surgeon, or apothecary residing near the place of death—nor without a certificate stating the cause of the person's death signed by his medical attendant—or if he had no such attendant, by one called in after death to view the body, but who shall not be concerned in examining the body after removal: such certificate to be delivered with the body to the party receiving the same for anatomical examination (sec. ix.).

Any person licensed to practice anatomy may, under these regulations, receive or possess any body for anatomical examination (sec. x.). On receiving it he must also receive with it the certificate as aforesaid, and this he must, within twenty-four hours after the removal of the body, transmit to the inspector, together with a return stating at what day and hour and from whom the body was received, the date and place of death, the sex, and (if known) the christian and surname, age, and last place of abode; and he must enter the same, with a copy of the certificate, in a book kept by him for that purpose, and to be produced whenever required by the inspector (sec. xi.).

No party may receive a body at any place for anatomical examination unless he, or the owner or occupier of that place, or some party licensed under this act to examine bodies, have given at least one week's notice to the secretary of state or the chief secretary, as the case may be, of the place where it is intended to practise anatomy (sec. xii.). Bodies must be removed in decent coffins or shells, and persons receiving them must make provision for their decent burial after examination (sec. xiii.).

No licensed person can be prosecuted for receiving or having in his possession any body which he has received according to the provisions of this act (sec. xiv.). The bodies of murderers are not to be dissected after execution, but shall be either hung in chains or buried within the precincts of the prison, as the court before which they were tried shall order.

Any person offending againt this act is deemed guilty of a misdemeanor, and on conviction may be imprisoned for any time not exceeding three months, or be fined not more than fifty pounds, at the discretion of the court before which he is tried.

SURHYA SIDDHANTA. We had intended, under the title of this Hindu work, to have given some account of the astronomy of that nation, but we find the question so mixed up with that of their other science, that we prefer to consider it all together under the head Viga Ganita.

SURIANA'CEÆ, a small natural order of plants formed by Lindley, and placed in the Gynobasic group of Polypetalous Exogens. The calyx is 5-parted, slightly imbricated; petals 5, equal; stamens indefinite, hypogynous, with round anthers, bursting internally with 2 longitudinal fissures; carpels 5, surrounding a small gynobase, with style arising from their base; fruit woody; seed solitary, exalbuminous. The species are woody plants, with alternate leaves without stipules, capitate jointed hairs, and racemose flowers. These plants are closely allied to Coriariaceæ and Geraniaceæ. They are found in the warmer parts of the world, South America, the Canaries, the South of Europe, New Caledonia, New Holland, and India. Lindley refers to this order Heterodendron and Cneorum, but they are doubtful occupants of this position; Suriana being the only other genus. This genus was named after Joseph Donat Surian, who was a physician and botanist of Marseille, and was the companion of Plumier in his travels in South America.

SURINAM. [Guiana, Dutch.]

SURNAME. [Name.]

SU'RNIA. [Strigidæ.]

SURPLICE, the white dress worn by the clergy in their acts of ministration, from the Latin *superpelliceum.*

Palmer says it is by no means improbable that the surplice was, in very antient times, not different from the albe; in fact it only varies from that garment even now in having wider sleeves. The inferior clergy were accustomed to wear the albe at divine service, as we find by the council of Narbonne (A.D. 589), which forbade them to take it off until the Liturgy was ended. Probably in after-ages it was thought advisable to make a distinction between the dresses which the superior and the inferior orders of clergy wore at the Liturgy, and then a difference was made in the sleeves; and from about the twelfth century the name of surplice was introduced. During the middle ages, bishops very frequently wore the surplice with a cope, and above the rochette. (Bona, *Rerum Liturg.*, lib. i., cap. 24, sect. 20; Wheatley's *Illustr. of the Book of Com. Pr.*, 8vo., Oxf., 1810, pp. 100, 101; Palmer's *Orig. Liturgicæ*, vol. ii., pp. 319, 320.)

SURRENDER. '*Sursum redditio* properly is a yielding up of an estate for life or years to him that hath an immediate estate in reversion or remainder, wherein the estate for life or years may drown by mutual agreement between them.' (Co. Litt., 337 b.) A surrender and a release both have the effect of uniting the particular estate with that in reversion or remainder; but they differ in this, that whereas a release generally operates by the greater estate descending on the less, a surrender is the falling of the less estate into the greater.

Coke mentions three kinds of surrenders: 1. A surrender at common law, which is the surrender properly so called; 2. A surrender by custom of copyhold lands or customary estates; and, 3. A surrender improperly taken, as of a deed, a patent, of a rent newly created, and of a fee-simple to the king. (Co. Litt., 338 a.)

1. The surrender at common law is of two sorts: 1. A surrender in deed or by words in writing, expressing the intention of the owner of the particular estate to yield it up to him in reversion or remainder; and, 2. A surrender in law, which is wrought by operation of law, and not actual; as if a lessee for life or years takes a new lease of the same land during the continuance of his term, this will be a surrender in law of the prior lease. (Co. Litt., 338 a.)

The requisites of a good surrender in deed are the following:—The surrenderor and surrenderee must be respectively persons capable in law of making and receiving the surrender; the surrenderor must have an estate in possession of the things surrendered, and not a mere future right; the surrender must be made to the owner of the next estate in reversion or remainder; the surrenderee must have a higher or greater estate in the thing surrendered than the surrenderor, so that the latter may be capable of merging in the former; the estate of the surrenderor must be in his own right, and not in that of another; and lastly, there must be a privity of estate between the surrenderor and the surrenderee. (Co. Litt., *ubi sup.*; Viner, *Abr.*, 'Surrender.') Though, by the Statute of Frauds, a surrender must now be in writing, it does not require the solemnity of a deed (unless the tenement lie in grant), nor of livery of seisin. (Co. Litt., *ubi sup.*; Touchstone, 307.)

A surrender in law may sometimes take place when a surrender in deed could not be made; as in the case where a man makes a lease for years to commence at a future day. This future interest, or *interesse termini*, cannot be surrendered by deed, because there is no reversion in which it can merge; but if the lessee, before the commencement of the term, take a new lease, it is a good surrender in law of the first. (5 *Rep.*, 11; Co. Litt., 218 b.) The surrender in law takes place in every case where a lessee accepts from the reversioner a new lease for any term whatsoever, to commence at any time before the expiration of the old one, so that if a lessee for life were to accept a term for years, there would be a surrender in law of his lease for life. In such a case it cannot properly be said that the previous term is merged in the reversion, unless the new lease commence immediately; but the implied surrender results from the supposed inconsistency of retaining the former estate, and accepting another in part concurrent with it.

A surrender may be either absolute or conditional. A grant of the immediate reversion by a lessor to his lessee, though it be only conditional, causes an irrecoverable merger of the term; but if a surrender has been made upon condition, an entry for condition broken may revest the particular estate. (Co. Litt., 218 b.)

The surrender of terms of years will sometimes be presumed from length of time alone; and many cases have arisen upon the question, after what periods mortgage terms which have been satisfied, and terms which have been assigned to trustees to attend the inheritance and have not been subsequently dealt with, will be presumed to have been surrendered. A full discussion of the cases on this subject will be found in Sugden on 'Vendors and Purchasers of Estates' (vol. iii., 25 to 67, 10th ed.), the general result of which may be stated to be, that where a term has never been assigned to attend the inheritance, the surrender of it may be presumed from the mere length of time elapsed without notice of or dealing with the term, and the question is one which may properly be left to a jury; but when a term has once been assigned to attend the inheritance, presumption of surrender ought not to be admitted unless there has been an enjoyment inconsistent with the co-existence of the term, or some act has been done in order to disavow the tenure under the termor, and to bar it as a continuing interest. [COPYHOLD; MERGER; RELEASE.]

2. As to surrender of copyholds, see COPYHOLD.

3. A surrender may be made of letters-patent and offices to the king, to the intent that he may make a fresh grant of the same right; and a grant of the second patent for years to the same person, for the same thing, causes a surrender in law of the first. (10 *Rep.*, 66.)

SURREY, an inland county of England, bounded on the north by Middlesex, from which it is separated throughout by the river Thames, on the east by Kent, on the south by Sussex, on the west by Hampshire, and on the northwest by Berkshire. The form of the county approximates to an oblong quadrangle, of which the eastern and southern sides are tolerably regular, but the northern and western sides less so. The length of the quadrangle from east to west, from the Kentish border near Westerham (in Kent) to the Hampshire border near Farnham, is 39 miles; the breadth from north to south, from the bank of the Thames at Blackfriars bridge, London, to the Sussex border near Crawley (in Sussex), is 25 miles. The area of the county is estimated at 759 square miles. The population at the different enumerations of the present century was as follows:—1801, 269,043; 1811, 323,851, increase 20 per cent.; 1821, 398,658, increase 23 per cent.; 1831, 486,334, increase 22 per cent.; 1841, 582,613, increase 19·7 per cent. It is in size the thirtieth of the English counties, being a little smaller than Westmoreland, and a little larger than Oxfordshire. Taking the census of 1831, there were 641 inhabitants to a square mile. It was in amount of population the fifth English county, being next below Devonshire, and next above Kent; and in density of population it was the third, being exceeded only by Middlesex and Lancashire. Croydon, Guildford, and Kingston are the county-towns. Croydon is about 10 or 10½ miles south of the General Post-office by the coach-road, and 10 miles by Croydon railway; Guildford is 30½ miles by coach-road south-west of the Post-office, or 33 miles by the London and South-Western railway to Woking Common, and from thence by coach-road; Kingston is 13 miles south-west of the Post-office by coach-road, and about the same distance by the London and South-Western railway. Guildford and Kingston are both on the Portsmouth road.

Surface and Geological Character.—The part of the county which lies north of a line drawn from the Kentish border near Beckenham, leaving Croydon a little to the south, and passing by Carshalton, Epsom, Ashtead, and Leatherhead, and from thence to the Hampshire border near Ash, leaving Guildford a little to the south, may be regarded as belonging, with some exceptions which we shall notice, to the London clay formation. The district occupied by this formation is comparatively low. It forms however the line of hills extending on the south side of London, from New Cross near Deptford, by Nunhead, Peckham, Denmark Hill, Herne Hill, Brixton Hill, Clapham Rise, and Battersea Rise, Wimbledon Common, and Richmond Hill. It also forms the hills running southward along the Kentish border from New Cross by Forest Hill, Sydenham, Penge Common, and Norwood. None of these are of much elevation, though some of them command extensive and beautiful prospects. The hills about Norwood are 389 feet above the level of the sea. Brick-earth is obtained in the London clay district near Kingston.

North of the hills which extend from New Cross to Battersea the London clay is covered by alluvium; and it is probable that the greater part of this flat was, anteco-

dently to the Roman period, overflowed by the river at every high tide, and formed an extensive marsh, which was gained from the river by embankment. Along the bank of the river too, between Putney and Richmond, the London clay is covered by alluvium.

The range of high and mostly waste grounds, Esher Common, Cobham Common, St. George's Hill (between Cobham and Weybridge), Woking Heath, Pirbright Common, Romping Downs, and Ash Common, which occur in the north-west part of the county, and which extend with slight interruption from the neighbourhood of Kingston to the Hampshire border,—the range of St. Ann's Hill (240 feet), Shrubs Hill, and the other hills west of Chertsey and Bagshot Heath, extending from near the Thames to the Berkshire border,—and the high ground of Chobham Ridges between these two ranges, are all formed of the siliceous sand and sandstone belonging to the upper marine formation, which here covers the London clay. The highest elevation does not exceed 463 feet. This formation presents a poor, hungry, unimproveable sand; and hence extensive wastes are allowed to remain, notwithstanding the proximity of the metropolis and the consequent impulse to cultivation.

South of the boundary-line of the London clay the plastic clay crops out, and occupies a long narrow district extending across the county from the Kentish to the Hampshire border, bounded on the south by a line drawn near Addington, Sanderstead, Banstead, Headly, Bookham, Horsley, and Guildford, and from thence to the Hampshire border. The breadth of the plastic clay district on the Kentish border is four or five miles, but it becomes narrower towards the west, and on the Hampshire border is probably not more than half a mile in breadth. The hills near Addington and Croydon, Banstead Downs (576 feet), and Epsom, Ashtead, and Leatherhead commons are on the plastic clay, which here covers the chalk with a thin bed; the chalk is quarried beneath it on Banstead Downs. Beds of fine clay of the plastic clay formation are wrought near Ewell, and red clay near Guildford. South of the plastic clay the chalk range of the North Downs rises. These downs extend from Kent across the county into Hampshire, interrupted only by the depressions through which the rivers Mole and Wey pass, and by a depression near Farnham. The southern escarpment may be traced running just to the north of Titsey, Godstone, Merstham, Gatton, Reigate, Betchworth, Dorking, Wotton, Albury, Shalford, Puttenham, and Farnham. Guildford is in the line of the downs in the depression through which the Wey passes. The breadth of the chalk district is greater on the eastern side of the county, and the downs there attain their greatest elevation. Botley Hill (880 feet), above Titsey, is the highest point. The breadth of the chalk district here is about four miles. Box Hill, near Dorking, overlooks the depression through which the Mole passes, and is, from the picturesque scenery which it presents, a favourite place of resort for the inhabitants of the metropolis. Between Dorking and Guildford the range of the downs gradually narrows; and between Guildford and Farnham it forms a remarkable narrow unbroken ridge, above six miles long and about half a mile broad, called the Hog's Back. The downs rise again beyond Farnham just on the border of Hampshire, into which they extend. The thickness of the chalk formation at Denbigh, north-west of Dorking, is 440 feet. The dip of the strata east of Guildford rarely if ever exceeds 15°: in the ridge of the Hog's Back it is 45°. The chalk is dug in different places and is burnt for lime.

From beneath the south escarpment of the North Downs the chalk marl and green-sand formations crop out. They occupy the valley which extends at the foot of that escarpment all through the county, and which valley east of Reigate is called Holmesdale; but as the formations extend southward from the chalk they rise into hills, extending south of Limpsfield and Godstone by Bletchingley, Nutfield, Red Hill, Park Hill, south of Reigate; and from thence south-west by Holmwood Common, Leith Hill (993 feet, the highest point in the county, and indeed in this part of England), Hurtwood Common, on which are Holmbury and Coneyhurst hills, Hascombe and Hambledon, to Hind Head Common (923 feet) on the Hampshire border. This range of hills presents a bold escarpment towards the valley on the south, and is broken by two considerable depressions, one near Reigate, by which the Mole passes through, and another between Hurtwood Common and Hascombe, through which a feeder of the Wey passes; and by some minor interruptions. Beds of chert occur in the chalk marl near Reigate, and fire-stone is dug in the same formation at Merstham. Flint and chalcedony occur commonly in the green-sand: in which also fullers'-earth beds occur at Nutfield, and crystallized sulphate of barytes of a yellow colour. The high grounds of these formations are almost entirely waste. On Hind Head Common occurs that remarkable hollow, the Devil's Punch-bowl, round which the Portsmouth road winds for nearly a mile.

The rest of the county, comprehending the whole of the southern border, except a very small part west of Haslemere, is occupied by the Weald clay and iron-sand formations. The latter only just appears at the south-eastern corner of the county, and will scarcely require notice. The Weald clay occupies the broad valley at the foot of the green-sand hills, and in some places forms the lower part of the south side of the hills. Brick-earth is dug in this part of the county, between Red Hill and Horley. Jet is said to have been wrought in the iron-sand formation in this county and in Sussex.

The green-sand hills and the part of the county south of them are included in the Weald district of Kent, Surrey, and Sussex.

Hydrography and Communications.—The county is included in the basin of the Thames, except three very small portions; two south of the green sand hills, which are drained by streams flowing into the Arun, and a third in the south-east corner of the county, which belongs to the basin of the Medway. The Thames, which forms the northern boundary, is navigable throughout for small craft, and up to London Bridge for sea-borne vessels. Those of its tributaries which belong to Surrey are the Bourn brook, the Wey, the Mole, the Hog's Mill river, the stream which joins the Thames above Putney, and the Wandle.

The Bourn brook rises near Bagshot, and flows by Chobham and Addlestone into the Thames below Chertsey, sending off one branch into the Wey; it receives a stream from Virginia Water in Windsor Great Park: its whole length is about 14 or 15 miles.

The Wey rises near Alton in Hampshire, and flows north-east nine or ten miles to the border of Surrey, which it enters not far from Farnham. From the border of the county it flows first north-east and then south-east by Farnham, six miles to Tilford, where it receives, on the right bank, a considerable stream from Woolmer Forest in Hampshire, and runs eastward seven miles to Godalming, where it becomes navigable. From Godalming it flows four miles north by east to Guildford, receiving by the way on the right bank two considerable streams, one of which rises on the south side of Hurtwood Common, and has a circuitous course of 15 miles, chiefly through the Weald clay valley, passing northward by a depression in the green-sand hills; the other rises on the north side of Leith Hill, and flows first northward and then westward 11 miles through the valley between the North Downs and the green-sand hills. From Guildford the Wey flows in a winding channel north by west by Woking, about 14 miles, into the Thames at Weybridge. At Pirford, below Woking, it receives on the left bank a stream 12 miles long, which rises on the northern slope of the Hog's Back, and at Weybridge one nine miles long, which rises on the northern slope of the North Downs between Leatherhead and Guildford. The whole length of the Wey is about 41 miles, for about 18 of which it is navigable.

The Mole rises in the northern part of the county of Sussex. The principal source is near Hand Cross on the Brighton road, and it flows northward about five miles to the border of Surrey, which it enters near Horley, and then flows still northward past Horley, five miles to Kennerley Bridge, two miles south of Reigate. Just above Kennerley Bridge it turns north by west, and flows six miles to Dorking through the valley between the North Downs and the green-sand hills. From Dorking the Mole winds northward through one of the most picturesque and beautiful parts of the country to Leatherhead, five miles following the channel of the river; and from Leatherhead it runs north-west five miles to Cobham, and there bending so as to form three sides of a small quadrangle, flows northward or rather north-north-east into the Thames at East Moulsey, opposite Hampton Court. Its whole course may be estimated at 42 miles. It is not navigable in any part. In

penetrating through the chalk range of the North Downs at the foot of Box Hill near Dorking, the Mole is subject to be occasionally absorbed by the spongy and porous soil through which it flows. There are probably caverns and hollows which communicate with the bed of the river, and which in ordinary seasons are filled with water; but when in time of drought the water which they contain is absorbed, the river is drawn off into them so as to leave the channel dry at Burford Bridge under Box Hill, and for some distance below it, except here and there a standing pool. At Thorncroft Bridge, near Leatherhead, the stream rises again, and below that point suffers no interruption. From the occasional occurrence of this phenomenon, the accounts of which have been much exaggerated, the river is supposed to have obtained the name of Mole; its more ancient name, at least in the upper part of its course, appears to have been Emlay. The name Mole is however as old as the Anglo-Saxon period, for Molesham (or Moulsey), which is evidently derived from it, is mentioned in 'Domesday.'

The Hog's Mill river rises in a copious spring in the village of Ewell, and flows north-west seven miles into the Thames at Kingston. It is not navigable, but turns several mills. The stream which joins the Thames near Putney rises at the foot of Banstead Downs near Cheam, and flows northward by Combe Wood, Richmond Park, East Sheen, and Barnes, where it turns east and joins the Thames half a mile above Putney Bridge: its length is almost 10 miles: it is not navigable. The Wandle rises near Croydon, flows three miles west to Carshalton, then turns and flows eight miles north-north-west by Mitcham, Merton, Garret, and Wandsworth, into the Thames: its course is only 11 miles, and it is not navigable, but few rivers are made more useful for supplying mills of all kinds.

The principal roads in the county are those which lead from the metropolis to the south-east, south, and south-west. The Dover road, as far as New Cross, near Deptford, is in this county. The Brighton road runs south from Southwark through Kennington, Brixton, Streatham, Croydon, and Merstham. Here it divides, one branch running through Reigate, the other running over Red Hill and through Horley. The two branches re-unite near Horley, and run across Lowfield Heath to Crawley in Sussex. The old Reigate and Brighton road appears to have passed, not through Brixton, Streatham, and Croydon, but through Clapham, Tooting, Mitcham, and Sutton, and over Banstead Downs. The Lewes and Eastbourn road branches from the Brighton road to the left a little beyond Croydon, and passes through Godstone. The Horsham and Worthing road branches from the Brighton road to the right at Kennington, and passes through Clapham, Tooting, Merton, Mordon, Ewell, Epsom, Leatherhead, and Dorking. The most frequented Portsmouth road leaves the metropolis at Hyde Park Corner, and enters the county over Putney Bridge, but formerly the more frequented road was through Southwark, Newington, and Wandsworth. The two roads unite beyond Putney, and run south-west by Kingston, Esher, Cobham, Ripley, Guildford, Godalming, and Mousehill. The Winchester and Southampton road branches from this to the right at Guildford, and runs west along the Hog's Back to Farnham. The Chichester road branches from the Portsmouth road to the left near Mousehill, and runs by Haslemere. The Salisbury and Exeter road enters the county across the Thames at Staines, and runs just within the north-western border and parallel to it through Egham and Bagshot.

A road branches from the Salisbury road on the left, and runs to Farnham, which is about as far distant from the metropolis by this road as by the road through Guildford. A road branches from the Worthing road to the right at Leatherhead, and runs to Guildford, which is about two miles farther by this road than by the road through Kingston. There are cross-roads from Kingston to Ewell; from Ewell by Cheam, Sutton, Carshalton, and Beddington, to Croydon; and from Guildford by Albury, Wotton, Dorking, Reigate, Nutfield, Bletchingley, Godstone, and Limpsfield to Westerham, Sevenoaks, and Maidstone in Kent.

The canals are the Grand Surrey Canal, the Wey and Arun Canal, and the Basingstoke Canal. The Grand Surrey Canal is cut from the Thames at Rotherhithe, about a mile and a half to the neighbourhood of Deptford, in Kent, and then turning west is carried two miles and a half farther to Camberwell. There is an extensive basin in the part of the canal near the Thames. The first act for making this canal was obtained A.D. 1801, and it was originally intended to carry it eight miles farther to Mitcham. Its length is four miles, almost entirely in this county. The Wey and Arun Canal, sometimes called the Surrey and Sussex Canal, commences in the river Wey near Shalford, between Guildford and Godalming, and runs south by east into Sussex, where it joins the Arun navigation near Billinghurst. The first and only act for this canal was obtained A.D. 1813: its length is nearly 18 miles, of which 11 miles are in this county. The Basingstoke Canal commences in the river Wey, about three miles above its junction with the Thames, and runs south-west nearly 12 miles to Frimley, near the border of the county; it then turns south and runs above three miles to near Aldershot, where it enters Hampshire: its whole length is 37 miles, 15 in this county. The Croydon Canal commenced in the Grand Surrey Canal near Deptford, and ran southward 9½ miles along the border of Kent and Surrey, having the middle part of its course in Kent, and the beginning and end in Surrey, to Croydon. But this canal has been drained, and its line is now occupied by the Croydon railway. It was commenced under an act obtained A.D. 1801.

There are several railways. The Surrey iron railway was made under acts obtained A.D. 1801, 1805, and 1806, and was opened A.D. 1805. It commences at a basin which connects it with the Thames at Wandsworth, and follows the course of the Wandle to Merton, from which place it takes a direct course to Croydon. Its length is about 9 miles, and the cost of construction was about 60,000*l.* There is a double line of rails throughout. The Croydon, Merstham, and Godstone railway commences at the Croydon end of the foregoing, and runs 8½ miles by the side of the Brighton road to Merstham. The first act was obtained A.D. 1803, and the railway was opened A.D. 1805. The cost of construction was 90,000*l.* It was intended to carry it to Reigate, with a branch to Godstone. This railway had a double line of rails; and, with the foregoing, served to convey the lime and fullers'-earth from the neighbourhood of Merstham to the Thames. This line was not intended for passengers. Horses were the moving-power employed. This railway has been purchased and closed by the Brighton Railway Company.

The London and Greenwich railway has about half its length, which is 3¾ miles, in this county. The first act was obtained A.D. 1833; and the line was opened to Deptford 1836, and throughout A.D. 1838: the capital raised was nearly 1,000,000*l.* It begins on the Surrey side of London Bridge, Southwark, and is carried throughout on a viaduct of about 1000 arches to its terminus not far from Greenwich church. The London and Croydon railway was commenced under an act obtained A.D. 1835, and was opened A.D. 1839. It commences in the London and Greenwich railway about 1¾ miles from London Bridge, and runs 8¾ miles, in great part along the former bed of the Croydon canal, to Croydon: the capital raised was 741,000*l.* The London and Brighton railway commences at the Croydon end of the London and Croydon railway, and runs by Merstham, Red Hill, and Horley to Brighton. This railway was commenced under an act passed A.D. 1837, and is now open throughout its whole length, which is 41½ miles, with a branch to Shoreham: the capital raised was 2,400,000*l.* The London and South-eastern (Dover) railway is to branch from this at Red Hill, and run eastward into Kent. This railway is in progress: the capital raised is 1,850,000*l.* The Greenwich, the Croydon, and the Brighton railways are designed for passengers; and locomotive steam-engines are employed as the moving-power.

The London and South-western (originally called the London and Southampton) railway was commenced under an act obtained A.D. 1834, and was partially opened in 1838, and wholly in 1840. It commences at Nine Elms, on the banks of the Thames, near Lambeth, and runs south-west by Wandsworth, Wimbledon, Kingston, Esher, Walton, Weybridge, and then nearly parallel to the Basingstoke canal, by Woking and Farnborough into Hampshire, where it runs to Basingstoke, Winchester, and Southampton. Its whole length is 76¾ miles, of which more than 30 miles are in this county: the capital raised was 1,860,000*l.* The line is designed for passengers and goods; and locomotive engines are employed. The Gosport Branch railway which runs from this line to Gosport, is wholly in Hampshire.

Agriculture.—The climate of this county is favourable for corn and grass. Along the Thames and the other rivers of

the county the air is soft and mild: where the ground rises into barren gravelly hills, or lies on the range of chalk which divides the county in a direction from north-east to south-west, from Croydon to Farnham, it is keener, and the winds are more boisterous. But hardy plants and robust constitutions are rather invigorated by it than otherwise. The soil varies greatly in different districts. The richest is that which lies along the banks of the rivers, consisting chiefly of a deep alluvial loam. On this soil, in the neighbourhood of London, are some of those extremely productive and highly cultivated market-gardens which supply the metropolis with fruit and vegetables. The immense quantity of manure which is annually laid on the land so occupied, and the deep trenching and digging which are repeated at short intervals, have converted the whole surface, to the depth of three feet or more, into a rich black vegetable mould. On this soil are raised the best and earliest culinary vegetables, which so rapidly succeed each other, that five or six different crops are sometimes gathered from the same ground in one year. There is another naturally rich black soil, which appears in small detached portions along the foot of the chalk hills. Although this soil requires great attention in its tillage, owing to its hardening in dry weather and being very soft and muddy when wet, it produces fine crops of wheat. The quantity of this soil however is small. The next in fertility is a hazel loam, with a considerable portion of calcareous earth in its composition, which is found on the northern side of the hills about Cobham, Ripley, Woking, and Horshill: the well-known hop-grounds in the neighbourhood of Farnham are mostly on a similar soil.

The most extensive tract is that of the Weald clay, which is a soil with a smaller mixture of siliceous sand than most clays. This weald extends into Sussex and Kent, and occupies most of the southern parts of the county. Some of it when ploughed rises in continuous strips, and is turned over in solid masses as if it were soap. In its natural state this soil is of little value, and can only be rendered productive by very complete draining, and by correcting the tenacity by chalk or gravel, where they can be found at hand, which however is seldom the case. The Weald is generally low and flat; where it rises into hills the soil is more fertile. In the northern portion of the county extending towards Hampshire is a large tract of sandy loam of various qualities, some of which remains to this day in the state of heath and commons. There are some sandy loams of a better quality between the barren soil known by the name of Bagshot sand and the chalk hills, as about Esher, Dorking, and Reigate: about Godalming it becomes of a very good quality, resting upon a sandstone. The poorer sands rest chiefly upon a yellow ferruginous gravel.

The tops of the chalk hills are either covered with a short pasture, as downs, or, where the soil is deeper over the chalk, it is mostly under the plough.

Surrey is a favourite county for the residence of men of fortune. It possesses many beautiful sites, and the views from some of the hills are very extensive, such as Richmond Hill, St. Ann's, Cooper's Hill, and Leith Hill. The villas within a short distance from London are very numerous, but few of them have more than a small quantity of pasture-land and pleasure-ground attached to them. Within a certain distance from London the larger properties have been mostly subdivided, and their value greatly increased from the competition of purchasers. Where land is held as an investment or inheritance, the rent is low, and the farms are not often let so as to encourage the tenant to lay out any capital. Where the tenure is from year to year, there is no security to the tenant in case of the death or failure of the landlord; and he is only restricted in his mode of cultivation by the custom of the country, than which nothing can be more vague. Two or even three white crops in succession are no infringement of the custom in some places, provided the land has been fallowed and manured. Where leases are granted, the conditions are often absurd and contrary to the principles of all improved husbandry, if they are not even contradictory and impossible. The consequence is that farmers who are of the old school continue a slovenly unprofitable system, by which they get a bare livelihood, and the land remains unimproved, if not deteriorated. There are proprietors, however, who are more alive to their own interest; who assist their tenants in draining, marling, or chalking their land; and who, by granting leases on fair terms, get respectable tenants with sufficient capital to cultivate the land properly. Most of the farms are smaller than is consistent with a wealthy tenantry. Provided a man has a sufficient capital, he can cultivate 500 acres as easily as 200, and can afford to use better and more improved implements. A lower profit per acre will remunerate him; while the small farmer requires all his profits to maintain his family. Till within a few years the poor-rates swallowed up a great portion of the rent; and the tenants, having their labour partly paid from the rates, were not inclined to lessen a burden which fell chiefly on the landlord, who was in consequence obliged to lower the rent. In some parishes the rates fully equalled the rent, and yet the aggregate was not too high for the tenant to pay. Land worth twenty shillings per acre let at ten shillings, the rates making ten shillings more; but the tenant had a profit on the rates by the reduction of wages, and the whole loss fell on the landlord. The removal of this abuse, and the commutation of the tithes, will tend greatly to the benefit of both landlord and tenant, and introduce a better system of cultivation.

The implements of husbandry used in Surrey vary extremely on different farms. Some adhere to the old clumsy Kentish wheel-plough, others adopt the more modern and improved forms. The strong turn-wrest plough, with four or six horses, may be very well adapted to break up rough ground full of stones and roots, although the modern subsoil plough would do this with much less power; but for ploughing land which is already in cultivation a lighter instrument is greatly preferable. A turn-wrest plough might be constructed as light as any swing-plough; and where the subsoil is porous, and the land can be laid flat, no plough does its work better than a good light turn-wrest plough; and as the system of under-draining extends, so will, no doubt, this implement. The skim-coulter, so generally used in ploughing leys, which turns in the surface and buries it, was invented by Ducket, at Esher in this county. On all the light soils swing-ploughs with a skim-coulter are universally used. The mole-plough is used as a substitute for underdraining, chiefly on meadows. Where the subsoil is a tenacious clay of a uniform texture, this instrument is efficacious; but where a variety occurs in the soil, it is only a temporary remedy against excess of moisture. The bore made by the plough is soon choaked, even if the moles do not work in it; and wherever this is the case, a springy spot is formed. On the light soils the seed is generally put in with a drilling-machine; on the heavier it is mostly sown broadcast. Dibbling is not much practised, except in the market gardens.

On the larger farms threshing-mills are common; but as the farms are mostly small, and the labourers abundant, the flail is the usual instrument of threshing.

The system of fallowing to clean the land, and to 'sweeten' it, as old farmers say, is almost generally adopted on the heavy soils: in fact there is no time in autumn or spring to clean land, which is then usually in a wet state; and the only crop which can be profitably raised in the fallow year is tares to cut up for horses or cattle. On the best soils this may take place on half the land usually fallowed; and if the tares are cut early in summer, or, which is better, fed off with sheep, the land may be got clean and in good order for wheat-sowing by what is called a bastard fallow. It is seldom that the season will allow of cleaning clay-land before spring-sowing. Fallows are therefore occasionally indispensable in such soils. The course of crops differs on the different soils. On all light soils the Norfolk four years' course is generally adopted, with occasional modifications. On the chalk sainfoin is sown with advantage, and broken up after five or six years. On the lands which are too wet for turnips to be fed off, the common course is—fallow, wheat, beans or clover, and oats. The long fallow for barley, which is so common in Essex and Suffolk, is almost unknown in Surrey: barley is seldom sown, except on the better light loams, where the Norfolk course is adopted. On the Weald clay the usual rotation is—fallow, wheat, clover, and oats, which is probably as good as any. Many farmers plant or drill beans on half the land which has borne wheat, and sow the other half with clover. If they give a half-dressing of manure for their beans, this is the best and most profitable course, as the clover then only recurs every eighth year. But this cannot be done without stall-feeding cattle on corn or oil-cake, or fattening pigs on the beans, where manure cannot be purchased; for the produce of the farm is mostly carried to market, and without oil-

make the straw of the wheat and oats would produce an insufficient portion of manure for the land, and that of a very inferior quality. The beans are carefully hoed by hand, where there is any pretension to good farming. Some old-fashioned farmers, especially among the small occupiers, adhere to the old course of fallow, wheat, oats, laying on all the manure they can make on the fallow for the wheat. The appearance of the land will readily show where this is the case, without asking a question; and the poverty of the farmer proves how unprofitable it is to the tenant, as well as the landlord. On the chalk soils, where there is a strong reddish clay, which the chalky subsoil prevents from being wet, turnips are added to the foregoing course, or rather the Norfolk course alternates with it, thus:—fallow well ploughed and stirred and folded with sheep; wheat, beans, oats, turnips dunged, barley, clover, oats or wheat, according to the fertility of the land. Peas are sometimes substituted for the beans, and tares made to precede the oats. There is no great fault to be found with this system, provided attention be paid to have a sufficient quantity of manure, either from sheep fed on the downs and folded at night on the land, or by the stall feeding of cattle. Without the advantage of the downs to feed the sheep, or grass-land attached to the farm, a proper quantity of manure could not be made. On all the good sandy loams the Norfolk course is universal, with the same variations which are found useful in that county. [Norfolk—*Agriculture*.]

The poor barren sands have been rendered productive in some spots by trenching and judicious planting. Where the iron pan, as it is here called, or the moor-band, which is an almost invariable concomitant of heath, is broken through, trees thrive well: where this is not done, planting is generally a dead loss. In the midst of the most desolate heaths in the county a cottage is sometimes erected by some poor man, with the consent of his parish, or by tacit acquiescence, with a garden in which fruit-trees grow and good vegetables are produced. This has been chiefly effected by deep digging, manuring with scrapings from roads and the ashes of the turf which serves for fuel mixed with the manure of the pig, which is littered with coarse grass or fern from the common. This shows that the soil is not irreclaimable; and it requires only the labour and care which are stimulated by necessity to convert these barren heaths into productive land. They are by no means so unpromising as some of the Dutch and Flemish heaths, which are now in full cultivation. [Barren Land; Flanders—*Agriculture*.]

We have mentioned sainfoin as a plant grown with great advantage on the chalky soils of this county, where it thrives well, and leaves the soil improved by the decomposition of its roots. It is usually sown with barley, as is the practice with clover, with this difference, that the land is ploughed deeper in order to loosen the chalky subsoil, into which the roots of the sainfoin strike to some depth. Some farmers sow trefoil at the same time; but the best farmers do not approve of this. The sainfoin alone will cover all the ground, and give a greater weight of fodder, whether green or made into hay, than the mixture; and the trefoil seems to act as a weed to the sainfoin, and to check its growth. As grass and weeds are great enemies to sainfoin, the land should be quite clean when the barley is sown—as it should at all events—that the sainfoin may choke the weeds and keep possession of the surface. It will bear a long continuance of dry weather without looking sickly, which is owing to the depth to which the roots grow. Sainfoin may also be sown before winter, if the soil is prepared; and in that case it is well to give it the whole surface of the land without any other crop. In the course of its continuance, which may be five or six years or more, the loss of the corn crop will be fully compensated. In order to have a fine sainfoin hay, it should be sown thick, to increase the number of stems without causing them to be too strong and woody, which would be the case if they had much room to grow in. A thick crop also keeps down the weeds. The proper quantity of seed is four or five bushels per acre. When the sainfoin is sown to stand for seed, a different mode of management must be adopted. In this case the plants cannot be too strong, and they should stand in rows a foot apart, and the intervals be hoed, as with beans; but in this case the plant will not be allowed to remain long in the land, and it will be better to cut it young for green food in the succeeding years than to make it into hay.

When sainfoin has been cut several years, it may be invigorated by top-dressing. The liquid manure, which is collected in tanks, and consists of the urine of stalled beasts and the drainings of dunghills, is the most effective recruiter of the soil. In Switzerland, where sainfoin is grown abundantly on the chalky slopes at the foot of the Jura Mountains, the inhabitants carry this liquid in flattened conical tubs slung on their backs, the wide part rising above their head; and distribute it by pouring it over the sides of the tub, right and left, by a peculiar stoop and jerk. One would suppose this to be a very slow and laborious process; but where carts could not well go, owing to the nature of the surface, it is the readiest means of carrying manure, and it is only mentioned here to prove how valuable a top-dressing it is found to be. It is in a very concentrated state, and usually put on in rainy weather, or in the evening to prevent burning. If a cart-load of rotten dung were well washed in as much water as will fill a large cart, it would be found to have imparted all its richness to the water, and left only insoluble fibres of straw behind. This quantity of liquid manure is as easy of carriage as a cartload of dung, and would invigorate a much greater extent of ground than if the solid manure were carted on and allowed to dissipate, in a great measure, before it is washed in by the rains. This is only anticipating what the rain will do less effectually, and avoiding the disappointment caused by dry weather.

Ashes are likewise a useful top-dressing for sainfoin. Peat and wood ashes are the best, no doubt, but coal-ashes, which may be obtained in larger quantities, have also a very good effect when well sifted from cinders. Gypsum has been used with advantage; but it is not yet known how it acts. In some soils its effects are scarcely perceptible, in others it seems to do wonders. Top-dressing not only produces a greater crop, but keeps the plant in vigour for a longer period when it begins to get thin; and as the expense of cultivation is confined to this top-dressing, the longer the field can be made to produce a good crop before it is broken up again, the greater the profit. To say that sainfoin does not exhaust the soil at all may perhaps not be warranted by theory or practice; but as it draws its nourishment chiefly from the chalky subsoil, and the graminem derive theirs mostly from the surface, it is reasonable to conclude that sainfoin exhausts this latter less, in proportion to the produce, than any other of the plants usually cultivated, lucern not excepted; for lucern requires a good friable soil to thrive in, and to enable it to last as many years as the sainfoin.

In making sainfoin hay great attention must be paid to the weather. It has a hollow stem, which in long continuance of wet weather becomes filled with water: in this case the hay can be seldom carried without danger of its becoming musty in the stack and being entirely spoiled. In very dry climates there is no fear on this account; but in our moist climate this is a serious evil. The situations in Surrey where the sainfoin grows best are also most open and exposed to the winds. If the proper time be chosen for making sainfoin into hay, which is when the flower is first beginning to fade, and the swarth be often turned without any tedding or spreading about, and soon made into small cocks, there will be no great danger of the stems being soaked with wet, even by very heavy showers. It must be left till quite free from moisture or sap before it is stacked, or it will become mouldy or heat dangerously, as the water or the sap prevails. Well got up sainfoin hay is nearly equal in value to clover hay, and much more nutritious than the best meadow hay. It is especially good for fast-working horses, as it affects the wind less than clover. Lucern and sainfoin hay are generally considered on a par, when equally well made. But if the most is to be made of the crop of either of these plants, they must be cut green, just as the flower opens, and given to horses and cattle in that state. One of the greatest enemies to the duration of a field of sainfoin is the oat-grass, which insinuates itself and ultimately thins the plants so much as to force the farmer to plough it up. This should be anticipated, and the ground ploughed and cleaned before the weeds have gained the mastery; for in that case it is difficult to eradicate them.

When a field of sainfoin is broken up, it should not be sown again for at least as many years as the sainfoin has lasted, or it will probably fail of giving such a crop as will keep down the weeds. There are some exceptions, at least it is so stated in books, where the land, being thoroughly cleaned by fallowing, sainfoin has been sown again immediately with success. But we would not recommend the

practice: it is better to choose another field, and let the sainfoin go the round of the chalky fields in succession: the crops which come after it will be all the better. These remarks may be taken as supplementary to what is said in the article SAINFOIN.

The hop-gardens of Surrey are about Farnham. The greater value of Farnham hops in the market is probably owing partly to the soil in which they grow being peculiarly suited to this plant, and partly to the greater care with which it is cultivated. The greater price obtained for the best Farnham hops is the stimulus to the exertions of the growers. For a detail of the culture and management, see HOPS.

The wealds of Surrey were, till within a comparatively modern date, one continued forest (*Wald*, in German), and were gradually cleared and cultivated, as timber was in request and land was wanted to raise corn, which, within little more than a century, the wealds did not produce in sufficient supply for the inhabitants, although the population was small. At present the woods have been greatly thinned, and the process of grubbing has gone on most rapidly. It has been found that the underwood, with a few trees interspersed, if properly taken care of, is more profitable than an open wood of thriving oaks, which have a slow growth and give a distant return, while the coppice is turned into money every ten, twelve, or fourteen years. Hence the management of underwood has been well attended to. The woods are kept dry on the surface by numerous open drains in the tenacious clay. The shoots have been plashed and laid down to take root where there appears any vacancy, and the woods have been carefully fenced from cattle and other trespassers. The best underwood consists of quick-growing trees, as ash, elder, sallow, and willow. The oak and chesnut are more precarious, although more valuable when in perfection. The coppice, if of any extent, is cut and sold by the proprietor or his agent. When it is included in a lease of a farm, from twelve to sixteen shillings per acre is an average yearly rent. When the lease is for twenty-one years, the farmer is induced to cut the coppice twice, although it does not produce so much as it would at twelve or fourteen years' growth, even allowing for the rent of the surplus years. It is therefore always preferable for the landlord to keep the coppices in hand.

The new plantations which are made are either merely ornamental, near the seats of proprietors, or are on the barren sandy soil, as mentioned before.

In the heaths and poor sands furze is often abundant, and gives some return, when cut and tied in faggots for heating bakers' ovens, and for the use of brick-makers and lime-burners. In some places it has been sown for this purpose, and has produced a good return at a small expense. A gallon of seed is sown per acre after the land has been cleared of heath and ploughed deep. The subsoil must be dry or the furze will not thrive. In the first year it may be mown, and the tops, bruised in a mill, are very good food for horses and cows. It may be cut afterwards every three years and tied up into bundles. An acre will produce from 2000 to 3000 bundles, worth six shillings a hundred delivered. This is a good return from such poor land.

There is no peculiar breed of cattle in Surrey. There is not much good grazing-land, and the beasts that are fatted or kept for milch-cows are of all the breeds which are usually met with. Short-horn and Alderney cows, and crosses between them, are very common in the pastures adjoining gentlemen's seats. There was a small herd of pure Ayrshire cows kept at Esher by the late R. Oswald, Esq., and a cross between these and the Alderney, which were very beautiful, and gave excellent cream and butter. They were sold and dispersed through the neighbourhood, and the breed will probably not be kept pure. Beasts of all breeds are fatted at the distilleries near London. Oxen for draught are very seldom met with, horses being almost universally employed for farm-labour.

There was once a peculiar breed of heath sheep, which had a small fleece of fine wool, and very delicate flesh when fatted. The meat was well known by the name of Bagshot mutton. There is only a small remnant of this breed left, as many of the heaths and commons have been divided, although not cultivated, and the sheep have no longer their former wild and extensive range. The farmers are partial to the South Down sheep, and some prefer crosses between these and the Leicester or the Cotswold, which give a heavier fleece and larger carcass. They also bear folding on the exposed hills. Several farmers about Ewell, Esher, and Walton, and towards Guildford, rear house lambs for the London market. The ewes are invariably of the Dorsetshire breed, which lamb early. They are well fed and closely housed, and the sucking lambs are treated in a manner very similar to calves fattening for the butcher. The great object is to get them fit for the market as early as possible in the season.

The pigs are principally of the Berkshire breed. There was formerly a very large breed at Rudgwick in this county. The hogs, some of which gave carcasses of forty and fifty score when fat, vied with oxen for weight. But these enormous animals took a long time to fatten, consumed a large quantity of food, and the bacon was not so readily disposed of as of the smaller sorts. This is a sufficient reason for their being less valued.

The principal fairs in Surrey are as follows:—

Blechingley, May 19, Nov. 2; Chertsey, first Mond. in Lent, May 14, Aug. 6, Sept. 25; Croydon, July 5, Oct. 2, Dorking, day before Ascension-day; Farnham, Holy Thursd. Midsummer-day, Nov. 13; Egham, May 29; Epsom, July 25; Esher, Sept. 4; Ewell, May 12; Walton-on-Thames, Easter week; Godalming, Feb. 13, July 10; Guildford, May 4, Nov. 22; Haslemere, May 13, Sept. 26; Kingston, Th. in Whitsun week, Aug. 4, Nov. 13; Leatherhead, Oct. 10; Merton, Easter Mond., Whit. Mond.; Reigate, Whit. Mond., Sept. 14, Dec. 9; Ripley, Nov. 11; Wandsworth, Whit. Mond.

Divisions, Towns, &c.—Surrey is divided into fourteen hundreds, as follows:—

Hundred.	Situation.	Area. Acres.	Population 1831.
Blackheath	S.	40,930	8,681
Brixton	N.E.	30,990	337,361
Copthorne	Central	34,730	10,727
Effingham	do.	7,060	1,646
Elmbridge	N.	21,100	8,048
Farnham	S.W.	26,680	8,228
Godalming	S.W.	*37,200	10,476
Godley	N.W.	43,730	14,517
Kingston	N.	12,690	17,491
Reigate	S.	45,150	10,719
Tandridge	S.E.	52,380	9,381
Wallington	E.	36,470	24,647
Woking	W. & Central	52,770	15,993
Wotton	S.	32,600	7,754
Militia under training		..	665
Total	. .	474,480	486,334

The metropolitan boroughs of Southwark and Lambeth are included in Brixton hundred, and Guildford is included in Woking hundred.

Surrey comprehends the parliamentary boroughs of Southwark, Lambeth, Guildford, and Reigate; the now disfranchised boroughs of Haslemere, Blechingley, and Gatton; the market-towns of Chertsey, Croydon, Dorking, Epsom, Farnham, Godalming, and Kingston; the suburban villages of Rotherhithe, Bermondsey, Newington, Walworth, Camberwell, Peckham, Dulwich, Norwood, Brixton, Kennington, Clapham, Wandsworth, Putney, Battersea, Tooting, and Streatham: and the remoter villages of Mortlake, Barnes, Kew, Richmond, Wimbledon, Merton, Mitcham, Ewell, Carshalton, Beddington, Wallington, Leatherhead, Walton-on-Thames, Esher, and Egham. Southwark is described elsewhere [LONDON; SOUTHWARK], as are some of the other places. [BATTERSEA; BLECHINGLEY; CROYDON; FARNHAM; and LAMBETH.]

Guildford is in Woking hundred, chiefly on the right bank of the Wey, and in that depression of the North Downs through which the river passes; 30½ miles from the General Post-office, London, by Kingston, or 31½ by Leatherhead. The area of the old borough was 210 acres. The present parliamentary and municipal limits, as determined by the Boundary and Municipal Reform acts, comprehend a much larger area. Guildford is mentioned first in the will of Alfred the Great, by whom, as being a royal demesne, it was bequeathed to his nephew Ethelwald, on whose rebellion or death a few years after it reverted to the crown. It was here that Alfred, the son of Ethelred II., was treacherously seized in the reign of Harold I. (A.D. 1036), and here his Norman attendants were massacred to the number of nearly six hundred. In 'Domesday'

the town is called Gildeford. It belonged to the king, who had seventy-five messuages or tenements (*hagæ*), from which and other data Manning (*History of Surrey*) conjectures the population to have been about 700. There are the remains of an old castle here of uncertain date, but it is probably later than the Domesday survey, as it is not noticed there. It was taken by Louis of France and the insurgent barons in the reign of John, A.D. 1216. It was alienated from the crown in the time of James I. The ruin stands on an eminence on the south side of the town, and not far from the east bank of the river. There are some remains of the outer walls. The shell of the keep is standing: it is a square tower, about 44 feet square outside, with walls ten feet thick in the lower story. The original entrance was through a stone arch in the west front, so high that it must have been approached by an outside staircase. This opening, which now commonly passes for a window, has a pointed arch, which, as the general character of the keep is Norman, was probably altered at a period subsequent to the erection. There was a circular staircase in one corner, and there were galleries in the walls as at Rochester. The town is on a declivity, and the High-street, which runs down to the bridge over the Wey, is steep. The town is well paved, and lighted with gas; and from the well-built and substantial houses which it contains has a thriving and respectable appearance. St. Mary's church, on a declivity to the south of the High-street, is a curious edifice, chiefly of chalk, very antient, and rudely built. Some parts are of early English, and others of later date. It consists of a nave with two aisles, and a chancel with a chapel on each side, forming an extension of the aisles, and originally communicating with the chancel by arches which are now stopped up. These chapels do not extend the length of the chancel, and are round at the east end. There is a small embattled tower in the centre of the building. Trinity church is near the eastern entrance of the town on the south side of the High-street. It was rebuilt of brick about the middle of the last century, with an embattled tower of the same material 90 feet high. St. Nicholas is on the west side of the Wey. It is an antient structure, rudely built of chalk and flints, with an intermixture of stone; and is of various dates and styles. It has a low embattled western tower entirely of stone, and some good lancet windows. On the north side of High-street, nearly opposite Trinity church, is Abbot's Hospital, or Trinity Hospital (erected and endowed by Archbishop Abbot, a native of Guildford), a building in the Elizabethan style, of imposing appearance, built round a quadrangular court. The gateway tower is square, with octangular turrets at the corner, surmounted with pinnacles. There is a grammar-school, an antient and spacious building. The old town-hall, or guild hall, is a large building, surmounted by a turret, and having a clock projecting into the street; and there are a new corn-market and court-house of neat and handsome appearance, and a neat theatre. The county house of correction is a brick building, well situated, about a quarter of a mile from the town; and there are extensive barracks on the site of an antient Dominican friary. Half a mile south of the town, on a hill to the left of the Godalming road, are the picturesque ruins of St. Catherine's Chapel. There are meeting-houses for several bodies of Dissenters.

The population of the old borough in 1831 was 3924, of the borough as subsequently extended probably about 4833. There is no important branch of manufacture carried on at Guildford. There are some paper and corn mills, breweries, and an iron-foundry. There are markets on Wednesday and Saturday, the latter a good corn-market. There is a weekly lamb-fair or market on Tuesday, from about Easter to Whitsuntide; and there are two yearly fairs for cattle and horses. There are two banking establishments. The Midsummer quarter-sessions for the county are held here, and the summer assizes alternately with Croydon. The court of election for members of parliament for the western division of the county is also held here.

The town was early incorporated, but the time is unknown: the earliest known charter is of Edward II. Quarter-sessions for the borough are held, and petty sessions as occasion requires. The town has, under the Municipal Reform Act, a commission of the peace, 4 aldermen, and 12 councillors. Guildford has sent two members to parliament ever since 23 Edward I. The number of voters on the register for 1835-6 was 430: for 1839-40, 495.

The livings of Trinity and St. Mary's are rectories, united, of the joint clear yearly value of 171*l.*, with a glebe-house. St. Nicholas's is a rectory, of the clear yearly value of 437*l.*, with a glebe-house. They are all in the rural deanery of Stoke, the archdeaconry of Surrey, and the diocese of Winchester.

There were in the old borough, in 1833, an infant-school with 123 children, 76 boys and 47 girls; the grammar-school with 74 boys, 6 on the foundation; an endowed blue-coat school with 56 boys, 26 of them on the foundation; two national schools, with 64 boys and 76 girls; a Lancasterian school, with 96 girls; and ten other day-schools, with 231 children, viz. 105 boys and 102 girls, and 24 children of sex not stated. There were also two Sunday-schools, with 352 children, viz. 158 boys and 194 girls; besides which 44 boys from one of the national schools attended on Sunday.

Reigate is in the hundred of Reigate, 22 miles from the General Post-office, through Croydon. The borough, which is now co-extensive with the parish, has an area of 5900 acres. This place is called Cherchefelle in 'Domesday,' but acquired the name of Reigate in the following century. It was a royal demesne at the time of 'Domesday,' and was afterwards granted to the earl of Warrenne and Surrey. There was a castle here, of the foundation and history of which little is known except that it was taken from Earl Warrenne by Louis of France and the insurgent barons, A.D. 1216. There are no remains of it now, except the earthworks which mark the site. There was also a priory, of which there are no remains: its yearly revenues at the dissolution appear to have been 78*l.* 16*s.* 8*d.* gross, or 68*l.* 16*s.* 8*d.* clear. The town is pleasantly situated in the valley of Holmesdale, at the foot of the southern declivity of the North Downs. It is a small but remarkably neat place, having an unusual proportion of genteel houses in it. It consists of one principal street, running east and west along the valley, and another street branching southward from this. The town is lighted with gas. The site of the castle is on the north side of the town, behind the houses in the High-street: the site of the priory is marked by a modern mansion, so called, at the southern end of the branch street. The church is at the east end of the town: it is built of squared chalk or limestone, probably from the neighbouring quarries, and is chiefly of perpendicular character, with some good windows, and a lofty embattled tower at the west end, of later date than the rest of the church. On the north side of the chancel is a brick vestry, built A.D. 1516, with an apartment over it containing a library for the use of the parish and neighbourhood. In a vault under the chancel Lord Howard of Effingham, afterwards earl of Nottingham, who commanded the English fleet against the Spanish Armada, and several of his family, are buried. There are meeting-houses for Quakers and Independents. There is a small brick market-house with a town-hall over, and a small building adjacent called the 'clock-house,' used for confining the prisoners brought here for trial at the sessions. The town-hall occupies the site of an antient chapel of St. Thomas à Becket; and there are some remains of another chapel, said to have been dedicated to St. Lawrence, now converted into a dwelling-house. There is a good market on Tuesday for corn and provisions, and a monthly cattle-market. There are three yearly fairs. The Easter sessions for the county are held at Reigate. Reigate is a parliamentary, but not a municipal borough. It returned two members from the 23rd Edward I., but the number of members was by the Reform Act reduced to one. The previously narrow limits of the borough were extended by the Boundary Act. The number of voters on the register for 1835-6 was 195; for 1839-40, 198. The living is a vicarage, of the clear yearly value of 418*l.*, with a glebe-house. It is in the rural deanery of Ewell, in the archdeaconry of Surrey, and the diocese of Winchester.

There were in the parish, in 1833, a free grammar-school, with 26 boys; a national school, with 66 boys and 60 girls; fourteen other day-schools, with 278 children, namely, 140 boys and 138 girls; and three Sunday-schools, with 171 children, namely, 30 boys and 141 girls.

Haslemere is in Godalming hundred, twelve miles south of Guildford, on the road to Chichester. The area of the parish is 3330 acres. There is a tradition of the former greatness of this place before it was ruined by the Danes, but the tradition is unsupported, nor is the place noticed in 'Domesday.' A charter granted by Queen Elizabeth in the 38th year of her reign speaks of the antiquity and populousness of the town, but refers to its existing impoverishment

from the extinction of its fair and market; in consequence of which the charter contains a grant for a market and two fairs. The town occupies an elevated site, and is very clean; the streets are irregularly laid out, and neither lighted nor paved. The church, or rather parochial chapel, of which Chiddingfold is the mother church, is on the north side of the town, and is an antient structure. The east window has some old painted glass. There is a small square tower at the west end. The Independents have a meeting-house; and on a common adjacent to the town is an almshouse which affords a dwelling to some poor persons, but they receive no allowance, owing to the decay of the market, from the tolls of which their stipend was derived. The population of the parish, in 1831, was 849. The market, which is on Tuesday, is kept up, but is of little importance: there are two yearly cattle-fairs. There was in 1831 a small manufacture of silk-crape which employed sixteen men. Haslemere sent members to parliament 'from time beyond memory,' according to the charter of Elizabeth; but it is questioned if any were actually sent until a few years before that charter was granted. They were regularly returned until the disfranchisement of the borough by the Reform Act. The living is a chapelry, united with the rectory of Chiddingfold; their joint clear yearly value is 522*l.*, with a glebe-house; they are in the rural deanery of Stoke, in the archdeaconry of Surrey, in the diocese of Winchester. There were in the parish, in 1833, a national school, with 60 boys; two other day-schools, with 14 boys and 29 girls; and one Sunday-school, with 40 girls.

Gatton is in Reigate hundred, about two miles north-east of Reigate. The area of the parish is 1140 acres, partly on the North Downs, partly at their southern foot. Some Roman antiquities have been found, and Gale contends for there having been a Roman garrison here, but of this there is no sufficient evidence. Aubrey, in his 'History of Surrey,' has spoken of a castle at Gatton, but without any known evidence from antient writers or any existing trace of its site. Gatton first sent members to parliament 29 Henry VI. (A.D. 1451), and returned two down to the time of its disfranchisement by the Reform Act. The place has entirely lost whatever importance it may have possessed, and is now a scattered village of only 23 houses and 145 inhabitants. Gatton House, the residence of the late Lord Monson, is a handsome residence in an extensive and beautiful park: the parish church, which is in the park, is remarkable for the neatness with which it is fitted up. Until the disfranchisement of the borough by the Reform Act, the proprietor of Gatton House was patron.

Chertsey is in Godley hundred, on the bank of the Thames, 22½ miles from the General Post-office, London, by Brentford, Twickenham, and Shepperton, and 11 miles west of Kingston through Hampton Court and East Moulsey. The area of the parish is 10,020 acres. The name of the place is written by Bede Ceortesei, and in the Saxon Chronicle Ceortes-ege and indicates the situation of the place, in a peninsula, which was perhaps once an island formed by the Thames, the Bourn brook, and the stream from Virginia Water. The town was known in antient times by its mitred Benedictine abbey, founded in the times of the Heptarchy. The yearly revenues of the abbey at the dissolution were 744*l.* 18*s.* 6¾*d.* gross, or 659*l.* 15*s.* 8¾*d.* clear. The body of Henry VI. was for a time deposited in this abbey. The town is irregularly laid out; the principal street runs east and west, the streets are partially paved and lighted with gas, and the houses are for the most part neatly built of brick. There is scarcely a fragment left of the abbey, which stood on the north side of the town, between it and the river, in a very low flat, now forming fertile meadows. The church is in the centre of the town, and is a modern brick building faced with stone, in what is described as the florid Gothic style. The market-house is also a modern building. An old house in the town possesses some interest as having been the residence of the poet Cowley. East of town is Chertsey bridge, a handsome stone-bridge over the Thames, erected in the latter part of the last century. There are several places of worship for Dissenters. There is a building for the Literary and Scientific Society, with theatre, lecture, and reading rooms. The population of the parish, in 1831, was 4795, about one-third agricultural: the population of the town is not given separately. The chief trade of the town is in malt and flour: a considerable quantity of vegetables are raised in the neighbourhood for the supply of London, and a great number of bricks are made. The market is on Wednesday for corn and provisions; it is a considerable market for poultry: there are four yearly fairs. The living is a vicarage, of the clear yearly value of 307*l.*, with a glebe-house, in the rural deanery of Stoke, in the archdeaconry of Surrey, and diocese of Winchester. There were in the parish, in 1833, two national schools, endowed, with 262 children, namely, 157 boys and 105 girls; eleven other day-schools of all kinds, with 196 children, namely, 68 boys and 128 girls; two other day-schools, from which there was no return; and two Sunday-schools, with about 100 children of both sexes.

Near Chertsey, on St. Anne's Hill, is the residence of Charles James Fox, commanding an extensive prospect. There is a tablet in Chertsey church, erected by his widow, with an inscription to his memory.

Dorking is in Wotton hundred, about 24 miles from the General Post-office, London, through Ewell and Epsom. The area of the parish is 10,150 acres. The town is of no historical interest; but is delightfully situated in the valley on the south side of the North Downs, near the river Mole. It is surrounded by gentlemen's residences: Betchworth castle and park on the east, Berry Hill on the south-west, and Churt park on the south-east. The principal street runs from north-east to south-west, the other streets branch from this. The footpaths are paved, and the streets lighted with gas, and the town presents a pleasing appearance: the houses, though antient, are neat and well built. The church is in the centre of the town, and is of ordinary stone and flint, except the upper part of the tower, which is of squared stone or chalk. The church is roofed with the coarse flagstone quarried near Horsham: it is cruciform, with the tower, which is low, in the centre; and is principally of perpendicular date. It contains the monuments of Abraham Tucker, author of 'The Light of Nature Pursued,' and of Jeremiah Markland, the classical scholar and critic. There is a town-hall in the middle of the High Street; and there are meeting-houses for Independents and Quakers. The population of the parish, in 1831, was 4711, about one-third agricultural: the population of the town itself was not distinguished. The chief trade is in flour and lime; and a great quantity of poultry of a peculiar breed, supposed to have been brought over by the Romans, and known by having five claws to each foot, is reared in the neighbourhood for the supply of the metropolis. The market, which is well supplied, is on Thursday, and there is one yearly fair. The living is a vicarage, of the clear yearly value of 411*l.*, in the rural deanery of Stoke, in the archdeaconry of Surrey, and the diocese of Winchester. There were in the parish, in 1833, an infant-school with 147 children, 99 boys and 48 girls; two national schools, held also on Sundays, with 138 children, 70 boys and 68 girls; a day and Sunday school with 16 girls, connected with Dissenters; and seven other day-schools, with 155 children, namely, 55 boys and 100 girls. Dorking is situated on or near the Roman road Stone Street, and it has been said that in digging graves in the churchyard the grave-diggers have occasionally come to the road-way, but this appears to want confirmation.

Epsom is about 15 miles from the General Post-office, London, on the Worthing road. The area of the parish, which is in Copthorne hundred, is 3970 acres: the population, in 1831, was 3231. The town is irregularly laid out, but has a number of good houses. The church is a modern building, and there are two Independent chapels. The market, which had been discontinued, has been lately revived: it is held on Wednesday. There is a considerable cattle and wool fair. Some brick-making, brewing, and malting is carried on, and there are some nursery-grounds. Epsom has mineral springs, now less resorted to than formerly; and in the week preceding Whitsun-week horse-races are held on the adjacent downs, and are very numerously attended, chiefly from London. The grand stand on the race-course is a spacious and handsome building. The living of Epsom is a vicarage, of the clear yearly value of 303*l.*, in the rural deanery of Ewell, the archdeaconry of Surrey, and the diocese of Winchester. There were in the parish, in 1833, a national school with 157 children, namely, 100 boys and 57 girls; fifteen other day-schools, with 316 children, namely, 144 boys and 172 girls; and two Sunday-schools, with 114 children, namely, 48 boys and 66 girls.

Godalming is in the hundred of Godalming, about 4 miles south-south-west of Guildford, on the Portsmouth road. The area of the parish is 8470 acres. The manor of Godalming was bequeathed by Alfred the Great to his

nephew Ethelwald, and on his revolt, or death (A.D. 905), reverted to the crown. to which it belonged at the time of Domesday Survey, in which it is called Godelminge. The town is of little historical interest. It was in 1724 the scene of a gross imposture by one Mary Toft, a woman who professed to be delivered of 17 young rabbits. The matter excited great attention; and numerous pamphlets, engravings, and squibs were published on the occasion. The town is situated in a valley amid the green-sand hills, on the south bank of the Wey, which is navigable up to the town. The principal street is about three-quarters of a mile long. The suburb of Mead-row and the village of Ferncombe on the north-east are nearly united to the town by intervening buildings. There is a brick bridge over the Wey. The town is paved and lighted: the houses are in general small and of mean appearance. The church lies back from the High Street, not far from the river: it is a cruciform church, having a low tower rising from the intersection, surmounted with an ordinary spire of timber covered with lead. There are some portions of early English architecture, and some curious windows of a later date. In it is a monumental tablet to the memory of the Rev. Owen Manning, the historian of the county, as well as a gravestone in the church-yard, where he was buried. There is a neat modern town-hall, and in the town and neighbourhood are some dissenting places of worship. The population of the parish, in 1831, was 4529. Godalming had formerly a flourishing manufacture of kerseys and other woollen cloths, but this is now decayed; the manufacture of silk and worsted stockings, shirts, drawers, fleecy hosiery, and gloves is still carried on. There are several corn, paper, oil, and fulling mills near the town. Timber, planks, hoops, bark, flour, and paper are sent by the Wey to London. There is a market on Wednesday for corn, and another on Saturday for provisions, and there are two yearly fairs. Godalming was made a corporate town by Queen Elizabeth. The limits of the borough are said to comprehend rather more than the present town, but are not exactly known; the corporation has no jurisdiction, civil or criminal, and no property; and the town was, before the Municipal Reform Act, lighted and watched under a local act unconnected with the corporation, and applicable to a very restricted district not exactly coincident with the borough. A more extended boundary has been recommended for the borough, which under the Municipal Reform Act has four aldermen and twelve councillors, and no commission of the peace. The living is a vicarage, of the clear yearly value of 461*l.*, with a glebe-house, in the rural deanery of Stoke, the archdeaconry of Surrey, and the diocese of Winchester. There were, in 1833, one infant-school with 52 children of both sexes; two national schools, with 207 children, namely, 109 boys and 98 girls; two Lancasterian schools, with 270 children, 140 boys and 130 girls; six other day-schools, with 225 children, namely, 137 boys and 88 girls; and two Sunday-schools, with 184 children, namely, 53 boys and 131 girls.

Kingston is in the hundred of Kingston, 13 miles from the General Post-office, London, on the Portsmouth road. It is on the east or right bank of the Thames, from which circumstance it is sometimes called Kingston-upon-Thames, to distinguish it from other Kingstons. The area of the parish, comprehending the town and the hamlets of Ham-with-Hatch and Hook, is 7300 acres: the total population in 1831 was 7257, namely, the town 5989, Ham-with-Hatch 1079, Hook 189. Many Roman antiquities have been found near the town, and some antiquaries have contended for this being the spot where Cæsar passed the Thames. There is thought to have been a Roman town or settlement a little to the east of the present town. It was a place of note in the Anglo Saxon times: several of the Anglo-Saxon princes were consecrated here. The name is written in the MSS. of the Saxon Chronicle Cingestune and Cyningestune: in 'Domesday,' where it is enumerated among the 'King's Manors,' it is called Chingestune. The first charter granted to the town was by John (A.D. 1199), and it sent members to parliament in the reigns of Edward II. and Edward III., but not since. Here Sir Thomas Wyat crossed the Thames in his attempt to possess himself of London. Here the Earl of Holland, with the Duke of Buckingham, and his brother Lord Francis Villiers, attempted to revive the Royalists' cause, in 1648, when a skirmish took place with some troops of parliamentary horse sent from Windsor to suppress the rising, in which skirmish the Royalists were defeated and Lord Francis Villiers slain. The town extends about half a mile along the banks of the river, and about a quarter of a mile inland from it. It is irregularly laid out, at the junction of the Hog's Mill river with the Thames: the streets are watched, and lighted with gas, under a local act. The houses are of ordinary appearance. There are houses extending, with little interruption, a considerable distance from the town along the roads to London and to Portsmouth. The church is an antient building, but has undergone from time to time numerous alterations and repairs: it is cruciform, and has an ancient tower rising from the intersection of the nave and transept. There are meeting-houses for different classes of Dissenters. There are a modern county court-house and a county house of correction. The town-hall is of the Elizabethan period; and there is a borough gaol of more modern date, a convenient building, used only for debtors, criminals being sent to the county house of correction. There is a grammar-school held in an antient building formerly a chapel dedicated to St. Mary Magdalen, and there are large national schoolrooms for boys and girls, and a school-room for the infant-school. The bridge over the Thames is of stone, with five arches: it was erected a few years since, at an expense of 40,000*l.*, in place of the ancient wooden bridge which previously stood here. The chief business of the town is malting, which is extensively carried on: there is also a considerable coal-trade. There are brick and tile works, and market-gardens round the town, and breweries and oil-mills in it. There is a market on Saturday, for corn, cattle, pigs, and provisions; another market, held on Wednesday, has been discontinued. There are three yearly fairs, but only one of them, a cattle, sheep, and horse fair, held in November, is of any importance. Kingston is near the line of the London and South-Western Railway. The corporation enjoys certain privileges and jurisdiction in the manor of Kingston, which, besides the parish of Kingston, includes the parishes of Petersham and Long Ditton, and other districts: it has also other privileges in the hundreds of Kingston, Elmbridge, Copthorne, and Effingham. Under the Municipal Reform Act there are six aldermen and eighteen councillors. The manor, which is regarded as the borough, is divided into three wards by the same act, and has a commission of the peace. A more restricted boundary has been proposed, yet extended in one direction so as to include Hamptonwick, on the Middlesex side of the bridge. General sessions of the peace are held at Easter and Michaelmas, and petty sessions weekly; besides which the Michaelmas quarter-sessions and the spring assizes for the county are held here, and the county magistrates hold petty sessions weekly. The court of record, which is held weekly, has jurisdiction in the four hundreds mentioned above. The ordinary yearly revenue of the corporation is above 700*l.* The living is a vicarage, united with the vicarage of Richmond, of the joint clear yearly value of 888*l.*, in the rural deanery of Ewell, in the archdeaconry of Surrey, in the diocese of Winchester. There were in the parish, in 1833, one infant-school in the town, with 80 children of both sexes, and another in the hamlet of Ham with 35 children; two day and Sunday national schools, with 340 children, namely, 240 boys and 100 girls; two other day and Sunday schools, endowed, with 80 children, 40 boys and 40 girls; thirty other day-schools, with 605 children, namely, 279 boys and 326 girls; and three Sunday-schools, with 274 children, namely, 126 boys and 148 girls.

Of the villages and parishes which adjoin the metropolis on the south, we first notice Rotherhithe. This parish lies in an angle of the river Thames, at the north-east corner of the county, and has an area of 690 acres. It has one long narrow street winding along the bank of the river, and a number of smaller streets or lanes. A considerable part of the lower road to Deptford is in it. The houses are generally of the poorer sort, and a large part of the inhabitants consists of seamen, watermen, or persons connected with shipping, and with the trades which supply shipping. The church was built early in the last century: it is a plain brick building with stone quoins, with a square tower, surmounted by a stone spire, at the west end. Among the monuments in the churchyard is that of Prince Lee Boo. The population of the parish in 1831 was 12,875. The Grand Surrey Canal and the basins connected with it are wholly in this parish, also the Commercial Docks and ponds, and the East Country Docks. There are several ship-building yards, timber-yards, and other establishments con-

nected with the ship-building business. There are also iron-works, corn-mills, and extensive granaries and warehouses for goods. The Thames Tunnel, now almost completed, has one of its entrances near Rotherhithe church. The living is a rectory, of the clear yearly value of *772l.* Three new churches or episcopal chapels have been erected, and there are several places of worship for Dissenters. There were in 1833 twenty-eight day-schools of all descriptions, with 852 children, namely, 493 boys and 359 girls; and five Sunday-schools, with 750 children, namely, 338 boys and 412 girls. Among the day-schools were the 'Free Charity and Amicable Society Schools,' with 150 boys and 50 girls; the 'United Society School,' supported by subscription, with 51 boys: and a charity-school with 50 girls, 20 of whom were clothed by the institution.

Bermondsey is on the south bank of the Thames, and lies between Southwark on the west and Rotherhithe on the east. The area of the parish is 620 acres. This parish is noticed in 'Domesday,' where it is called *Bermundeseye:* it had a Cluniac priory, founded by Aylwin Child, a citizen of London. A.D. 1082: the yearly revenues at the dissolution were 548*l.* 2*s.* 3¾*d.* gross, or 474*l.* 14*s.* 4½*d.* clear. Bermondsey now consists of a number of paved streets and roads with flagged footpaths, lined in some few parts with tolerably good houses, but more commonly by others of an inferior description. The old church is a building of little architectural pretension; but there is a new church (St. James's) of good appearance, and there are some dissenting meeting-houses. The population, in 1831, was 29,741. Near the water-side there are wharfs, and the various trades connected with shipping are carried on; and in that part of the parish which lies back from the river there are many tan-yards. There is a considerable extent of ground occupied by market-gardens. The London and Greenwich Railroad runs through the parish. The living is a rectory, of the clear yearly value of 511*l.*, with a glebe-house: the perpetual curacy of St James's Church, to which the rector presents, is of the clear yearly value of 300*l.* There were, in 1833, ninety-one day-schools of all kinds, including an infant-school with 60 children, namely, 35 boys and 25 girls; the Bermondsey Free-school, supported by endowment, with 80 boys; and six schools supported by subscription, namely, the United Charity-School, with 193 boys, 50 of whom were clothed by the institution; another charity-school with 126 girls; a Lancasterian school with 300 boys; two Catholic schools, with 150 boys and 100 girls; and another school with 20 boys and 32 girls. There were also five Sunday-schools.

Rotherhithe and Bermondsey are, for parliamentary purposes, included in the borough of Southwark.

Newington adjoins the south side of Southwark, and is bounded by Lambeth parish on the west, and on other sides by the parish of Camberwell. Newington is in great part incorporated with the metropolis: it includes several important thoroughfares, as one side of Newington Causeway and of the Brighton road, and both sides of Great Dover Street, the great southern and south-eastern outlets of the metropolis. It includes also the village or hamlet of Walworth, on the Camberwell and Norwood road. The streets generally have flagged footpaths, and are lighted with gas. The principal thoroughfares and some other streets have a number of good houses; but the back streets, for the most part, have houses of an inferior description. The old church is a heavy, ugly building; but the new churches, Trinity Church, Trinity Square, and St. Peter's, Walworth, are of better character. There are several dissenting meeting-houses. The county court-house, where the winter sessions are held, and one of the county prisons, are at Newington. The population of Newington parish, in 1831, was 44,526. The living is a rectory, of the clear yearly value of 1300*l.*, with a glebe-house: it is in the peculiar jurisdiction of the archbishop of Canterbury. There were in the parish, in 1833, one hundred and seventy day-schools of all kinds and ten Sunday-schools. Among the day-schools were, an infant-school, with 140 children, namely, 87 boys and 53 girls; a national school, with 515 children, namely, 330 boys and 185 girls; a Lancasterian school, with 350 boys; the Walworth Charity-School of Industry, with 100 girls; and the York Street Charity-School, with 70 girls.

Camberwell is an extensive parish, extending from the boundaries of Rotherhithe and Bermondsey on the north to Croydon on the south: its area is 4570 acres: the population, in 1831, was 28,231 The village of Camberwell adjoins Walworth on the south, and consists of four principal thoroughfares meeting in an open green, and leading respectively to London by Walworth, to Deptford by Peckham, to Kennington and to Norwood by Denmark and Herne hills. These thoroughfares are lined with good houses, especially in the direction of Denmark and Herne hills, which are lined by a succession of genteel villa residences pleasantly situated. Camberwell old church, an antient building, was destroyed by fire not long since, and has not yet been rebuilt. There is a new church, St. George's, near the Grand Surrey Canal. A chapel on Denmark Hill is in the parish of Lambeth. The living of Camberwell is a vicarage, of the clear yearly value of 1820*l.*, with a glebe-house: the perpetual curacy of St. George's, in the gift of the vicar, is of the clear yearly value of 500*l.*

Peckham is a hamlet of Camberwell, which it adjoins on the east: it consists of the main street on the road from Camberwell to Deptford, and of some others. There are a number of good houses, especially those which have been built round a large common called Peckham Rye. One of the new cemeteries for the metropolis is at Nunhead, near Peckham Rye. Peckham has two episcopal chapels of no architectural pretension, and several dissenting places of worship.

Dulwich lies in a hollow about 2 miles south from the village of Camberwell, and consists of a number of genteel pleasant residences. The only buildings requiring notice are, the College of God's Gift, which has been much improved in appearance during the last few years; and the episcopal chapel, a plain building, at East Dulwich: behind the college is a picture-gallery, containing some fine paintings, chiefly by the old masters. [ALLEYN; BOURGEOIS.]

Norwood is south from Dulwich: it has a number of scattered villa residences; a mineral spring, the Beulah Spa, in a pleasure-ground delightfully laid out; two episcopal churches, one of Grecian, the other of Gothic architecture; and a large public cemetery, with episcopal and dissenting chapels for performing the burial service. Norwood is partly in Lambeth, partly in Croydon parish.

Brixton is a hamlet of Lambeth parish, and contains a number of genteel residences on the Brighton road. There is a new church, St. Matthew's, at the foot of Brixton Hill; an episcopal (formerly dissenting) chapel in North Brixton; and there are several dissenting meeting-houses. On Brixton Hill is a house of correction for the county, and a handsome building for the St. Ann's Society Schools. There are also some almshouses, built and endowed by the late Thomas Bailey, Esq. The perpetual curacy of St. Matthew's is of the clear yearly value of 650*l.*

Kennington adjoins Brixton on the north: it comprehends a tolerably extensive common, on which a handsome new church (St. Mark's) has been erected, and roads leading from this common in various directions: there are a number of good houses round the common and along the main lines of road: in some of the back streets are also some genteel residences. There was formerly a royal palace at Kennington. There are three proprietary episcopal chapels besides St. Mark's Church: there are also some dissenting chapels. South of Kennington, on the Clapham road, is Stockwell, where is a chapel-of-ease. Both Kennington and Stockwell are in Lambeth parish. The clear yearly value of the perpetual curacy of St. Mark's is 700*l.*

Clapham lies south west of Stockwell, on the road from London to Epsom, Horsham, and Worthing. It is mentioned in 'Domesday,' where it is called Clopeham. The area of the parish is 1070 acres: the population, in 1831 was 9958. Clapham Common, an open space of about 200 acres, partly in this parish and partly in Battersea, is planted with trees, so as to present the appearance of a park, and is surrounded by handsome houses. There are also a number of handsome houses along the road from London to the common. At one corner of the common is the parish church, a plain brick building. There are two episcopal chapels; St. Paul's, on the site of the old parish church, and St. James's, a modern building of Gothic architecture, in what is termed Clapham Park. There are some dissenting places of worship. The living of Clapham is a rectory, of the clear yearly value of 1275*l.*, with a glebe-house. The clear yearly value of the perpetual curacies of St. Paul's and St. James's is 200*l.* and 500*l.* respectively.

Wandsworth is on both sides of the river Wandle at its junction with the Thames. It is about 7 miles from the General Post-office, on the old Portsmouth road The Lon-

don and South-Western Railway and the Surrey Iron Railway run through the parish. Wandsworth is called in 'Domesday' Wandesorde and Wendlesorde. The area of the parish is 1820 acres: the population, in 1831, was 6879. The main street is along the Portsmouth road. There are some good mansions, inhabited chiefly by wealthy Londoners. There are manufactures of British matting, bed-sacking, bolting-cloths, wire-blinds, candles, and hats: there are a distillery, vinegar-works, malthouses, breweries, dye-houses, corn and paper mills, an iron-foundry, lime-kilns, coal-wharfs, and calico print-works. The church is a plain modern building; and there are two chapels-of-ease, St. Anne's and Summer's Town chapels; and some dissenting places of worship. There are gas-works, a police-station, a savings-bank; and infant, national, and Lancasterian schools; and a school of industry, besides a number of private schools. In Garrott Lane, between Wandsworth and Tooting, it was customary to hold a mock election on the meeting of every new parliament; but this piece of burlesque has been discontinued for several years: it gave subject and title to one of Foote's dramatic pieces. Several of the French Protestant refugees in the seventeenth century settled at Wandsworth. The living is a vicarage, of the clear yearly value of 840*l.*, with a glebe-house: the perpetual curacy of St. Anne's Chapel is of the clear yearly value of 162*l.*

Putney adjoins Wandsworth on the west, on the road to Richmond, and lies on the bank of the Thames, across which there is a wooden bridge, erected in the early part of the last century, connecting this village with Fulham in Middlesex. The area of the parish is 2280 acres; the population in 1831 was 3811. A bridge of boats was thrown over the river at Putney by Fairfax, in the great civil war, and the army made it their head quarters in 1647. Thomas Cromwell, earl of Essex, and Gibbon the historian, were natives of Putney. The place is of little trade. The church is chiefly of the time of Henry VII., but some parts are older: at the east end of the south aisle is a little chapel, built by West, bishop of Ely, in the time of Henry VIII.: this chapel is adorned with rich tracery. There is a dissenting place of worship. At Roehampton, a hamlet of Putney, near Richmond Park, are some handsome villas. The living of Putney is a perpetual curacy, in the peculiar jurisdiction of the archbishop of Canterbury, of the clear yearly value of 362*l* There are a national and an infant school. Battersea is described elsewhere. [BATTERSEA.]

Tooting lies south-west from Clapham, and south-east from Wandsworth: it comprehends Upper and Lower Tooting. Upper Tooting is a hamlet of Streatham: Lower Tooting, or Tooting Graveney, is a separate parish, whose area is 680 acres; the population in 1831 was 2063. The principal street of Upper Tooting lies along the Horsham and Worthing road: Lower Tooting is partly on, partly to the left of the road. The parish church of Lower Tooting has been rebuilt within the last ten years, and is a handsome building: there is a chapel-of-ease at Upper Tooting, or rather on Balham Hill, close to it; and there are some dissenting places of worship. The living of Lower Tooting is a rectory, of the clear yearly value of 374*l.*, with a glebe-house. There are two national schools, an endowed parochial school, and an infant-school.

Streatham lies south from Brixton, on the Brighton road. Its name is supposed to be derived from its situation on the Roman road from London into Sussex. The area of the parish is 2770 acres: the population in 1831 was 5068. The principal street extends along the Brighton road, and in it are a number of handsome villas. There is a mineral spring at Streatham, the waters of which are regarded as of some virtue in scorbutic complaints. The church was partly rebuilt about ten or twelve years since: there are Independent and Wesleyan meeting-houses. There are an infant-school and a national school in Streatham parish. The living is a rectory, of the clear yearly value of 1136*l.*, with a glebe-house.

Rotherhithe and Bermondsey are included in the parliamentary (but not in the municipal) borough of Southwark: Newington, with Walworth, Camberwell, Peckham, Brixton (partially), Kennington, and Stockwell, are in the parliamentary borough of Lambeth. All the villages described above are in Brixton hundred, and all the parishes are in the rural deanery of Southwark.

Mortlake is in Brixton hundred, on the south bank of the Thames, between Putney and Richmond. The area of the parish is 1910 acres the population in 1831 was 2698. There are a number of handsome residences on the bank of the Thames. Mortlake church is antient, and there is an Independent chapel. Barnes (area of parish, 820 acres; population, in 1831, 1417) adjoins Mortlake on the east, and Kew (area 230 acres; pop. in 1831, 1837), where was a royal palace, now demolished, adjoins it on the west. The gardens of Kew Palace contain a very extensive and complete collection of exotic plants. There is a stone bridge over the Thames at Kew. Kew church was built early in the last century, and has been enlarged since then. There are several market-gardeners in and round these villages, and there are malthouses and a pottery at Mortlake, where also some trade is carried on in corn and coals. Mortlake is a perpetual curacy, in the peculiar jurisdiction of the archbishop of Canterbury, of the clear yearly value of 132*l.* Barnes is a rectory, of the clear yearly value of 375*l.*, with a glebe-house; and Kew a vicarage, united with the chapelry of Petersham, a village between Richmond and Kingston, their joint clear yearly value being 401*l.* Barnes, Kew, and Petersham are in the rural deanery of Ewell, in the archdeaconry of Surrey, and diocese of Winchester.

Richmond is on the south-east bank of the Thames, which here flows to the north-west, 11 miles from the General Post-office, London. The area of the parish (which is in Kingston hundred) is 1230 acres; the population in 1831 was 7243. There was a royal residence here in the time of the Plantagenets. The village was called Sheen before the time of Henry VII., who rebuilt with great magnificence the royal palace, which had been burned down A.D. 1499, and called the place Richmond, from his having borne the title of earl of Richmond before his accession. Richmond Palace was a favourite residence of Queen Elizabeth, who died here A.D. 1603. It was pulled down in part in the middle of the seventeenth century, and still further demolished in the eighteenth. Its site is now occupied by houses built on the crown lands, which have been leased, but some of the offices yet remain. The present park is to the south-east of the village. It was enclosed by Charles I., in whose time it was called 'The New Park:' it is about eight miles round, enclosed by a brick wall, and comprehends 2253 acres; only a small part is in Richmond parish. The Old Park, or the Little Park, which was formed by the union of two previously existing parks, distinguished from each other by the respective epithets of 'great' and 'little,' or sometimes of 'old' and 'new,' is on the north west and north sides of the village; it comprehended, in 1649, 349 acres. It was partly occupied as a grazing-farm in the time of George III., and was partly laid out in gardens, which were enlarged and united with those of Kew. In the gardens stands the observatory built by George III. The lodge which adjoined this park was the occasional residence of George II., his queen Caroline, and George III.: it is now pulled down. There was antiently a Carthusian priory at Richmond. It was restored after the general suppression by Queen Mary I., but existed at Richmond only a year. The members on the second suppression retired to Flanders, where the community still existed till late in the last century.

Richmond is delightfully situated on the side and summit of an eminence on the banks of the Thames, over which there is a handsome stone bridge. Along the brow of the hill is a line of genteel houses, with a terrace in front commanding a prospect of exceeding richness and beauty; and along the banks of the river are some delightful villas and grounds. Richmond is a favourite place of resort in summer for the inhabitants of London, with which there is at that season communication several times a day by steam-boats and omnibuses. The parish church is a neat brick building of modern erection. In the church or churchyard are the tombs of Kean, the tragedian, of Gilbert Wakefield, and of Dr. John Moore, the author of 'Zeluco.' There is also a brass plate with an inscription to the memory of Thomson, the poet, who died at Richmond in 1748. There is a chapel-of-ease, and there are places of worship for Independents, Baptists, Wesleyan Methodists, and Roman Catholics, the latter a very neat structure. Richmond has little other trade than such as is necessary for the supply of the inhabitants and visitors: it has some handsome inns and hotels. There are two or three malthouses and breweries, and some market-gardens and nursery-grounds in the vicinity. There are a literary and scientific institution, a Mechanics' Institution, a dispensary, a savings-bank, an infant and a national school, and several private schools,

especially boarding-schools. The living is a vicarage, united with that of Kingston.

Wimbledon is in Brixton hundred, west of Tooting, between the Portsmouth and Worthing roads. The parish comprehends 3700 acres; the population, in 1831, was 2195. Wimbledon park extends northward to the Portsmouth road, and comprehends an area of 1200 acres: it belongs to Earl Spencer. West of the park is Wimbledon Common, nearly as extensive, on which is an antient circular entrenchment. The church is a modern building. There are meeting-houses for Independents and Wesleyan Methodists. Merton is in Brixton hundred, and on the Worthing road: it adjoins Wimbledon on the south. The parish has an area of 1540 acres: the population, in 1831, was 1447. Mitcham is in Wallington hundred, between the Worthing and Brighton roads: the area of the parish is 2670 acres; the population, in 1831, was 4387. Merton had an abbey for the regular canons of St. Augustin, the yearly revenues of which at the dissolution were 1039*l.* 5*s.* 3*d.* gross, or 957*l.* 19*s.* 5½*d.* clear. Merton has some historical interest: its abbey was the place of meeting of the assembly which enacted the 'Provisions of Merton.' [HENRY III.] Part of the outer walls and the east window of the abbey chapel are still standing. Merton church has some Norman and early English portions, mingled with others of later date: Mitcham church has some portions of perpendicular date. The river Wandle flows through these three villages, and contributes to manufacturing operations. There are several establishments for printing calicoes and silks; and there are considerable copper-works; leather-dressing is carried on; and there are several flour, snuff, and drug mills, and two or three malthouses and breweries, and gardens and fields for aromatic and medical herbs. Mitcham is a vicarage; Merton and Wimbledon are perpetual curacies: their respective yearly values are 456*l.*, 93*l.*, and 170*l.*: Mitcham and Merton have glebe-houses: all are in the rural deanery of Ewell.

Ewell is about 13 miles from the General Post-office, on the Worthing road. The parish, which is partly in Copthorne, partly in Reigate hundred, has an area of 2410 acres; the population, in 1831, was 1851. The village is in Copthorne hundred, near the foot of Banstead downs. A little to the east of it, but in Cuddington parish, are the remains of Nonsuch Palace, built with great magnificence by Henry VIII. The streets of Ewell are well paved. The market has been discontinued, but there are two yearly fairs, one of them a very large sheep-fair, and considerable trade is carried on. There are a brick, tile, and pottery work, and several corn and gunpowder mills. The living is a vicarage, united with the perpetual curacy of Kingswood chapel, of the clear yearly value of 277*l.*, in the rural deanery of Ewell.

Along the road that leads by the foot of Banstead downs from Ewell to Croydon are the villages of Cheam, Sutton, Carshalton, Wallington, and Beddington, all in Wallington hundred. Beddington and Carshalton are on the Wandle, and had, in 1831, a joint population of 3348. There are several flour-mills, and there are drug, snuff, flock, paper, and oil mills, a silk and woollen print-work, and a distillery of mint and lavender water. Some leather-dressing is also carried on. Carshalton church has some early English and some decorated English portions. Beddington church is handsome, with a fine tower: it is mostly built of flint and stone, and is of perpendicular character.

Leatherhead is nearly midway between Epsom and Dorking, on the Worthing road. The parish, which is in Copthorne hundred, had, in 1831, a population of 1724. The village has little trade: some malting, brewing, and tanning is carried on. It had formerly a market, now disused. The church is antient and cruciform; the chancel is of decorated character, the north transept perpendicular. There is an Independent chapel.

Walton-on-Thames is in Elmbridge hundred, on the south bank of the Thames, about 4 or 5 miles west of Kingston. The population in 1831 was 2035. It is near the line of the London and South-Eastern Railway. It has a number of handsome villas and mansions, among which are Oatlands, the residence of the late duke of York. There is a church of considerable antiquity, and an Independent chapel. South-east from Walton, on the Portsmouth road, is Esher, near which is Claremont House and park, the residence of the late princess Charlotte of Wales, who died there.

Egham is near the north-western boundary of the county, on the banks of the Thames, on the high road to Salisbury, 21 miles from the General Post-office through Hounslow and Staines. The principal street extends for above a mile on the high road, and contains a number of respectable houses. The parish has an area of 7440 acres: the population in 1831 was 4203. There are a parish church, a modern brick building, and a Wesleyan chapel. In the parish, near Virginia Water, above a mile from the town, a new church has been erected. Egham has a good local trade. North of the village, on the bank of the Thames, is Runnymead, where King John signed Magna Charta. The living of Egham is a vicarage, of the clear yearly value of 575*l.*, with a glebe-house.

Divisions for Ecclesiastical, Legal, and Parliamentary Purposes.—The county is wholly in the diocese of Winchester, in which it constitutes the archdeaconry of Surrey. It is divided into three rural deaneries, Ewell, Southwark, and Stoke; antiently there were four, Ewell, Southwark, Guildford, and Croydon; Guildford is now Stoke, and Croydon has been chiefly united to Ewell. Some other alterations have been made, but they are of little moment. The number of ecclesiastical cures of all kinds is as follows:—

Rural Deaneries.	Rectories.	Vicarages.	Perp. Curacies.	Donatives.	Chapelries.	Total Cures.
Ewell .	27	18	14	2	7	68
Southwark	15	3	16	1	19	54
Stoke .	35	15	12	1	8	71
	77	36	42		34	193

The county is in the Home circuit, except that for criminal offences the parts of the county nearest to the metropolis are in the district of the Central Criminal Court. The spring assizes for the county are constantly held at Kingston; the summer assizes alternately at Guildford and Croydon. The Epiphany quarter-sessions for the county are held at the sessions-house, Newington; the Spring sessions at Reigate; the Midsummer sessions at Guildford; and the Michaelmas sessions at Kingston.

There are county prisons at Newington (Horsemonger Lane), Brixton, Kingston, Guildford, and Croydon. The prison in Horsemonger Lane, Newington, is of quadrangular form, the airing-yards of the criminal division being enclosed within the building, which consists of three stories above the basement. Part of the building is appropriated to debtors. The construction of the prison is defective, according to the present system of prison discipline; but it is solidly built, and in substantial repair. The number of prisoners confined here in the course of the year is very great. The management is very imperfect. The prison at Brixton is a semi-octagonal building, with the chapel in the middle, in a healthy situation on the rise of Brixton Hill: it is used exclusively as a house of correction. The construction of the prison is defective; but the general management, cleanliness, and order are very creditable. It was in this prison that the first treadmill was erected. The prison at Kingston consists of three or four detached buildings badly constructed and arranged. It is small and insufficient, though the number of prisoners is not great; so that the discipline is necessarily very defective. The prisoners are persons under summary conviction, prisoners intended to be admitted as witnesses on behalf of the crown, and persons remanded for re-examination. Guildford prison is on an eminence near the Wey, within a quarter of a mile of the town: it is solidly built and in good repair, and though of better construction than was usual at the time it was built, is defective when considered in reference to the improvements which have been made in prison discipline. The prison at Croydon is small, having only four cells and a large day-room: it is used as a lock-up house for prisoners charged with felonies or misdemeanors in Croydon parish, for persons committed by the court of requests, and for prisoners brought here for trial when the assizes are held at Croydon. There are, besides these, three prisons in the borough of Southwark, namely, the Queen's Bench and the Marshalsea prisons and the Borough Compter.

Before the Reform Act, fourteen members were returned to the House of Commons from the county of Surrey; two for the county itself, and two each for the boroughs of Southwark, Guildford, Haslemere, Gatton, Blechingley, and Reigate. By the Reform Act Haslemere, Gatton, and Blechingley were altogether disfranchised, and Reigate was reduced to one member: but the county was formed

into two divisions, each returning two members, and the borough of Lambeth was created, which returns two members, so that the present number of members sent from Surrey is eleven; two for each division of the county, two each for Southwark, Guildford, and Lambeth, and one for Reigate.

The two divisions of the county are as follows:—East Surrey comprehends the hundreds of Brixton, Kingston, Reigate, Tandridge, and Wallington: the court of election is held at Croydon; and the polling-places are Croydon, Reigate, Camberwell, and Kingston. West Surrey comprehends the hundreds of Blackheath, Copthorne, Effingham, Elmbridge, Farnham, Godalming, Godley, Woking, and Wotton: the court of election is held at Guildford; and the polling-places are Guildford, Dorking, and Chertsey.

The parliamentary constituency in the years 1835-6 and 1839-40 was as follows:—

	1835-6.	1839-40.
East Surrey	5308	..
West Surrey	3681	..
Southwark	5388	5047
Lambeth	7154	6547
Guildford	430	495
Reigate	195	198

The returns for 1839-40 do not include the county of Surrey, for what reason is not stated.

The boundaries of Southwark, Guildford, and Reigate were enlarged by the Boundary Act. The important parishes of Bermondsey, Rotherhithe, and Christchurch, and the Clink liberty in St. Saviour's parish, were added to Southwark: the districts thus added contained, in 1831, a population of about 60,000. The parts added to Guildford contained a population of about 1100: those added to Reigate contained a population of about 3400. The borough of Lambeth comprises the parish of Newington and parts of Camberwell and Lambeth parishes, with a population, in 1831, of nearly 155,000.

History and Antiquities.—At the earliest historical period this county seems to have been, for the most part, included in the territory of the Regni (Ῥῆγνοι, as Ptolemy writes the name), a nation, probably of the Belgic stock, who occupied also the adjacent county of Sussex. Probably some parts of the eastern border were included in the territory of the Cantii, who occupied Kent, and perhaps some parts of the western border may have belonged to the Atrebates, another Belgic nation, who inhabited Berkshire and Hampshire. Manning would identify the Regni with the Segontiaci of Cæsar; but we are not aware of any other reason for this than that Cæsar does not mention the Regni by name, and as he certainly marched through their territories, it is probable that they are mentioned by him under some other. Richard of Cirencester, who calls the Regni *Rhemi*, identifies them with the Bibroci of Cæsar, which is a more probable conjecture than Manning's. In his second expedition Cæsar advanced westward from Cantium, or Kent, through this county to the Thames, which he crossed probably at a ford at Coway Stakes, near Walton-on-Thames, though some fix his passage at or near Kingston. Gale observed traces of a camp, which he supposed to be Roman, about a mile and a half south of the ford at Coway Stakes. Several antient entrenchments are still existing in the county: on Bagshot Heath, about 4 miles beyond Egham, there is a very large one, in form approaching a parallelogram; on St. George's Hill, between Weybridge and Cobham, is another of irregular form, following the shape of the hill on which it stands; on Wimbledon Common is a third, of circular form; near Farnham, partly in this county and partly in Hampshire, is another, popularly called 'Cæsar's Camp,' of irregular form, following the brow of the hill on which it stands; and in Manning's 'Hist. of Surrey,' Roman camps at Anstey, in Milton Manor, near Dorking, at Holmbury Hill, on Hurtwood Common, and at Hascombe, near Godalming, are mentioned. There is a piece of ground on Worms Heath, near Chelsham, between Croydon and Titsey, called 'the camp;' the ground is broken by irregular pits and banks, but no lines can be traced.

Surrey was included in the Roman province of Britannia Prima. No Antonine station is ascertained to have been in it; though Londinium (London) and Pontes (Staines) were close on the border, in Middlesex, and Noviomagus the Νοιόμαγος of Ptolemy, the capital of the Regni, was probably at Holmwood Hill, close on the eastern border, in Kent.

It is probable that several Roman roads crossed this county: the most remarkable and best known is that which ran from Londinium. Its direction does not appear to be ascertained until it reached Woodcote park, near Epsom: it probably passed through Streatham and Wallington near Croydon. Some writers make the road to have passed through Tooting, Merton, and Ewell, nearly in the line of the present road. Beyond Woodcote park it appears to have run over Mickleham downs to Dorking, and from thence by Ockley, beyond which it is known as Stone-Street Causeway, into Sussex. Possibly there was a branch from Dorking westward, in the direction of Guildford and Farnham, into Hampshire.

Another road is supposed to have run into Sussex near East Grinstead. It is supposed to have branched from the road just described near Croydon; but if the opinion be adopted that the road described above ran not by Croydon, but by Ewell, this road must have branched from it much nearer London: in which case it probably ran through Streatham (which appears to have received its name from being on a street or Roman road), and from thence south by Godstone (near which is a place called Stratton, with the traces of an antient fortification), and so into Sussex. Some antiquaries fix Noviomagus at Woodcote near Croydon. It is probable that the Roman road from Londinium to Calleva and Sorbiodunum (Silchester and Old Sarum) crossed the north-western border beyond Staines. Traces of Roman buildings have been found in various places, as at Albury near Guildford, at Guildford, where some Roman bricks have been incorporated in the castle walls, at or near Kingston, and on Walton heath, Walton-on-the-Hill, north-east of Dorking.

It seems most likely that Surrey was, in the earlier period of the Heptarchy, a part of the kingdom of Wessex, not, as is commonly supposed, of Sussex. It was included, as it appears, from the earliest period in the West Saxon diocese of Winchester; and the earliest hostilities which broke out among the Anglo-Saxons, after their settlement in Britain, was the war between Ethelbert of Kent and Cealwin of Wessex, whose territories it is reasonable to suppose were conterminous. Added to this, Wibbandune, where the battle which decided that war was fought, and which is generally supposed to have been Wimbledon in Surrey, was in all probability in the territory of one of the contending parties, and not within the limits of a third and neutral state; and as Ethelbert was the aggressor, it was probably in the territories of Cealwin. In the later period of the Heptarchy it appears however not to have been an integral part of the territory immediately governed by the West-Saxon kings, but to have constituted a detached principality governed by a sub-regulus or dependent king. Whether this was the case from the first settlement of the Saxons is not clear: but if a judgment may be formed from its name, 'Suth rige,' 'the southern kingdom,' which is descriptive of its situation relative not to Wessex, nor to Sussex, but rather to Middlesex and the other Mercian territories, it was perhaps detached from Wessex by the Mercian kings as they rose to supremacy, and by them formed into a separate state. Thus much is certain, that in the middle part of the seventh century it was governed by Frithewald as sub-king, under the supremacy, not of the king of Wessex, but of Wulfhere of Mercia, who also conquered the Isle of Wight, and obtained the supremacy over Sussex. From this time Surrey appears to have depended on Wessex or Mercia, as the power of one or the other preponderated. In A.D. 785, Cynewulf, king of Wessex, was killed at Merantune, probably Merton, where he was visiting a lady, by Cyneheard his kinsman, a dependent prince whom he had wished to deprive of his principality, which, from the scene of this catastrophe, was probably Surrey. Cyneheard was slain next day, with his adherents, by the West Saxon nobles. At this time then Surrey appears to have been dependent on Wessex; but it must soon after have been detached from it, for the inhabitants are said willingly to have submitted to Egbert (A.D. 823), from whose government they had been for some years withheld. From the manner in which the transaction is recorded, it seems likely that Surrey and Sussex had been added, probably by Cenwulf of Mercia, to the kingdom of Kent, which was itself a dependency of Mercia, and which the Mercian kings would naturally desire to strengthen at the expense of Wessex. After the supremacy of Wessex had been finally established by Egbert, Kent, in this enlarged extent, continued to exist as a separate but dependent kingdom.

On the death of Egbert (A.D. 837) his son Ethelwulf succeeded him as king of Wessex, and Athelstan, son of Ethelwulf, as sub-king of Kent. By one or both of these princes the Danes were defeated with great slaughter (A.D. 851) at Aclea or Ockley in Surrey. In 853 the men of Surrey assisted in defeating the Danes in the Isle of Thanet; but lost their Ealdorman, or governor, Huda, or Wada, who was slain in the action. The history of the subsequent period is obscure. On the death of Athelstan it appears that Ethelbert, third son of Ethelwulf, succeeded as sub-king of Kent; but when Ethelwulf was dethroned from Wessex by his second son Ethelbald, he took the title of king of Kent, with a nominal supremacy over Ethelbald. Whether Ethelbert resigned the government of Kent to his father Ethelwulf, or shared it with him, or whether Ethelwulf had no more than a nominal power anywhere, is not clear. On the death of Ethelwulf (A.D. 856 or 857) Ethelbert reigned in Kent; and on the death of Ethelbald (A.D. 861) Ethelbert succeeded both to Kent and Wessex, which for several reigns remained under the same king. In all these arrangements Surrey seems to have formed part of the kingdom of Kent.

In the war of Ethelred or Ethered I., with the Danes, the king and his brother Alfred were defeated at Mere-tune, probably Merton in Surrey (A.D. 871), and Ethelred received a wound, of which he died soon after. In the struggle of Alfred with the Danish chieftain Hasten or Hastings, the Danes were beaten by the king's army at Farnham (A.D. 894). It is possibly to some period of the struggle between the Anglo-Saxons and the Danes that we may refer the couplet quoted by Camden:—

> 'The vale of Holmesdall
> Never wonne, ne never shall.'

Holmesdale is the valley under the southern side of the North Downs, between them and the green-sand hills.'

Some of the Anglo-Saxon kings were consecrated at Kingston: Athelstan, A.D. 925, and Ethelred II., A.D. 979. In A.D. 1042, the Anglo-Danish king Hardhacnute, or Hardicanute, died through excessive drinking at Lambeth.

It was a little before this time that Alfred, son of Ethelred II., was seized at Guildford, his eyes put out, and his followers massacred.

After the Conquest, William, Earl Warrenne, a follower and son-in law of William the Conqueror, received the grant of many lordships in Surrey, and was by William Rufus, soon after his accession (A.D. 1087 or 8), made earl of Surrey. On the extinction of the male line, in the person of his grandson (A.D. 1148), the earldom passed to William of Blois, son of King Stephen, and to Hamelin Plantagenet, natural brother of Henry II., who successively married the heiress of the House of Warrenne, and in the family of the latter, in the male line, it continued till A.D. 1347. From this line the earldom of Surrey passed to the families of Fitz-alan (A.D. 1347), Holland (A.D. 1397), Fitz-alan again (A.D. 1400), then, after a period in which it was dormant, to the families of Mowbray (A.D. 1451), Plantagenet (A.D. 1476-7), and Howard (about 1483-4), in which last family it has remained ever since. It is the second title of the duke of Norfolk, and is given by courtesy to his eldest son.

In A.D. 1215, the Great Charter and the Charter of the Forests (Magna Charta and Charta de Foresta) were signed by John at Runnymead, near Egham, on the border of this county. By Henry III. the whole county, which had been gradually afforested by his grandfather Henry II. as a part of Windsor Forest, was, with the exception of Guildford park, disafforested. Edward I. attempted, but without success, to extend Windsor Forest again into the county. The attempt was renewed as late as the time of Charles I., but again came to nothing.

In the civil war of John, Guildford and Farnham castles were taken by Louis of France and the insurgent barons. In the civil war of Henry III., a body of royal troops, retiring from Tunbridge to Bristol, after the battle of Lewes, A.D. 1264, took Blechingley castle, and routed a body of Londoners at Croydon. In the reign of Richard II. (A.D. 1294), his queen, Ann of Bohemia, died at Shene, now Richmond. In the rebellion of Sir Thomas Wyatt (A.D. 1554), he took possession of Southwark, and marching to Kingston, forced a passage over the Thames into Middlesex, though the bridge at Kingston had been broken down. Queen Elizabeth died at Richmond (A.D. 1603). Just before the civil war of Charles I., Lord Digby and some other Royalists, going to Kingston, gave occasion to the House of Commons, who regarded the visit as of a warlike character, to pass some strong resolutions, and was one of the circumstances which led to Lord Digby's impeachment. In the war itself the county was devoted to the parliamentary cause. After the battle of Edge Hill, and the advance of the Royalists toward London, part of the earl of Essex's army was posted at Kingston (A.D. 1642). Farnham castle, which was held by the Royalists, was taken not long after by the Parliamentarians. In the year 1647 the army, which was at variance with the Parliament, was partly quartered in this county. St. George's Fields, near Southwark, were the scene of the riots occasioned by the struggle of Wilkes against the government (A.D. 1768), and in the same place the Protestant Association under Lord George Gordon assembled (A.D. 1780).

Surrey had at different periods before the Reformation about thirty religious houses of all kinds. Of these the most eminent were the abbeys of Bermondsey (Cluniac), Chertsey (Benedictine), Merton (for regular canons of St. Augustin), and Waverley (Cistercian); and the priories of St. Mary Overy, Southwark, and Newark, in the parish of Send near Guildford, for regular canons of St. Augustin; and Shene, now Richmond, for Carthusians. The remains of Merton abbey have been noticed. Of Bermondsey and Chertsey abbeys, and of Shene priory, scarcely a fragment is left. The priory church of St. Mary Overy is noticed elsewhere. [SOUTHWARK.] There are some remains of Waverley abbey, near Farnham, overgrown with ivy, and extending in detached fragments over a surface of three or four acres: they comprehend some remains of the church, refectory, dormitory, and cloisters. There are some remains of the church of Newark priory. Many of the parish churches in the county are of great antiquity. The early English style, which was in use in the reigns of Richard I., John, Henry III., and Edward I., is prevalent.

(Manning's *History of Surrey*; *Beauties of England and Wales*; Conybeare and Phillips's *Outlines of the Geology of England and Wales*; Greenough's *Geological Map of England and Wales*; Priestley's *Navigable Rivers and Canals*; Rickman's *Gothic Architecture*; Lysons's *Environs of London*; Richard of Cirencester; *Ordnance Map*, and *Map of Antient Britain*, by the Society for the Diffusion of Useful Knowledge; Palgrave's *Rise and Progress of the English Commonwealth*; Ingram's *Saxon Chronicle*; *Parliamentary Papers*.)

STATISTICS.

Population and Occupations.—The population of the county is agricultural, except in so far as the borough of Southwark and the hundred of East Brixton form an important portion of the metropolis. Out of 44,139 males aged 20 and upwards employed in retail trade or in handicrafts in 1831, only about a fourth were resident in the parts of the county beyond the limits of the borough and hundred above mentioned, the number in the borough being 10,197, in the hundred 21,258; and in all other parts, comprising about fourteen out of fifteen parts of the whole area of the county, the number was 12,684. 'In the villages between Croydon and Wandsworth the river Wandle is applied in aid of calico bleaching and printing at Wallington, Mitcham, and Merton; to copper-works in the parish of Wimbledon, and to dyeing at Wandsworth. Besides these (collectively not including more than 100 men) 75 potters and weavers find employment at Battersea; at Farnham is a small manufactory of floor-cloth; at Haslemere of silk crape, and Godalming, one of the earliest stations of the stocking-weaving machinery, retains a portion of that manufacture.' (*Census*, 1831.) At the same period, of males aged 20 and upwards, there were 1873 occupiers of land employing labourers; 727 occupiers not employing labourers; and 16,761 were agricultural labourers. The remainder of the male population aged 20 and upwards was thus distributed:—employed in manufactures, 2065; in retail trades and handicrafts, 44,139; capitalists, bankers, and members of the professions, 14,235; non-agricultural labourers, 24,878; domestic servants, 4131; other males aged 20 and upwards, 10,756. The number of male servants under 20 was 2101; and there were 24,540 female servants.

The population of the county at the following periods was as under:—

	Males.	Females.	Total.	Increase per Cent.
1801	127,138	141,905	269,043	
1811	151,811	172,042	323,851	20·3
1821	189,471	208,787	398,658	239
1831	230,860	255,474	486,334	21·9
1841	278,186	304,427	582,613	19·7

The population increased 313,570 from 1801 to 1841, being 116 per cent.; the increase for England during the same period being 79·9 per cent. The details of the census of 1841 are not yet fully published, but the number of inhabited houses was 95,375; uninhabited 3948; and 1210 were building.

The population, &c. of each hundred and borough, according to the census of 1831, was as follows:—

HUNDREDS, BOROUGHS, &c.	HOUSES.				OCCUPATIONS.			PERSONS.			
	Inhabited.	Families.	Building.	Uninhabited.	Families chiefly employed in agriculture.	Families chiefly employed in trade, manufactures, and handicraft.	All other Families not comprised in the two preceding classes.	Males.	Females.	Total of persons.	Males twenty years of age.
Blackheath	1,504	1,678	10	41	1,042	432	204	4,523	4,158	8,681	2,247
Brixton	40,880	57,092	777	4,003	2,585	28,267	26,240	112,058	133,802	245,860	58,438
Copthorne	1,850	2,094	8	65	861	630	603	5,384	5,343	10,727	2,881
Effingham	242	315	0	7	190	72	53	861	785	1,646	449
Elmbridge	1,518	1,649	13	75	624	443	582	3,903	4,145	8,048	2,026
Farnham	1,472	1,634	5	29	924	458	252	4,032	4,196	8,228	1,945
Godalming	1,843	2,147	4	41	1,052	746	349	5,259	5,217	10,476	2,636
Godley	2,693	2,963	26	111	1,352	809	802	7,252	7,265	14,517	3,588
Kingston	2,999	3,812	14	144	619	1,593	1,600	8,195	9,296	17,491	4,474
Reigate	1,713	1,997	3	52	1,160	541	296	5,435	5,284	10,719	2,881
Tandridge	1,585	1,782	3	38	1,171	371	240	4,938	4,443	9,381	2,483
Wallington	4,350	4,902	65	345	985	2,856	1,061	12,120	12,527	24,647	6,219
Woking	2,110	2,452	10	56	1,405	597	450	6,048	6,021	12,069	3,209
Wotton	1,251	1,465	9	36	595	494	376	3,908	3,846	7,754	1,918
Guildford (Borough)	630	760	8	17	35	464	261	1,961	1,963	3,924	963
Southwark . do.	13,430	22,335	118	1,042	47	10,843	11,455	44,318	47,183	91,501	23,208
Militia								665			
Totals	80,070	109,077	1073	6,102	14,647	49,616	44,814	230,860	255,474	486,334	119,565

County Expenses, Crime, &c.—Sums expended for the relief of the poor: 1748-49-50 (annual average), 26,598*l.*; 1776, 49,744*l.*; 1783-84-85 (average), 66,156*l.* The sum expended in

1801 was	133,874*l.*,	being	9*s.*	11*d.*	for each inhabitant.
1811 ..	217,757	"	13	5	"
1821 ..	242,921	"	12	2	"
1831 ..	265,389	"	10	10	"
1841 ..	199,477	"	6	10	"

In each of the following years ending 25th March, the expenditure was as under:—

1835.	1836.	1837.	1838.	1839.	1840.
£225,120	£187,896	£151,959	£154,937	£164,227	£169,952

The expenditure for the year ending 25th March, 1834, was 261,501*l.* The saving effected between that year and 1840 amounted to 132,794*l.*, or 39 per cent.: namely, under the head of relief and maintenance, 91,549*l.*, or 35 per cent.; in suits of law, &c., 5151*l.*, or 58 per cent.; and in miscellaneous expenses, 36,094*l.*, or 51 per cent. The number of poor-law unions is 18, comprising 143 parishes and a population of 427,829, according to the census of 1831: there are 7 parishes with a population of 54,324, which are not in any union. The number of paupers relieved during the quarter ending Lady-day, 1840, was 32,946 (9705 in-door, and 23,241 out-door), being 8 per cent. of the population, the proportion for England being 8·6 per cent. The illegitimate births in 1830 were 399, or 1 in 40; in England 1 in 20. The numbers affiliated in 1834-5 were 263; and in 1835-6, 158. Bastard children chargeable on the poors'-rate in 1835-6, 2082, or 1 in 234 of the whole population:—in England 1 in 215. Lunatics and idiots chargeable on the same fund in 1836, 504, or 1 in 965;—in England 1 in 1033. Proportion per cent. of persons married (in the extra-metropolitan districts) under 21 years of age, in 1840, 8·5;—in England and Wales, 9·6 for the two sexes.

The annual value of real property assessed to the property-tax in 1815, was 1,579,172*l.*; and of property assessed to occupiers, 439,322*l.* the profits of trade, &c. were assessed at 1,583,080*l.* The sum raised for poor-rate, county-rate, and other local purposes, for the year ending 25th March, 1833, was 378,151*l.*, levied as follows:—

On land	£108,447
Dwelling-houses	240,389
Mills, factories, &c.	27,187
Manorial profits, navigation, &c.	2,127
Total	£378,151

The amount expended was—

For the relief of the poor	£278,375
In suits of law, removal of paupers, &c.	8,667
For other purposes	98,403
Total money expended	£385,445

The county expenditure in 1834, exclusive of that for the relief of the poor, was 25,872*l.* disbursed as follows:—

Bridges, building, repairs, &c.	£738
Gaols, houses of correction, and maintaining prisoners	11,663
Shire-hall and courts of justice, building, repairs, &c.	188
Lunatic asylum	194
Prosecutions	3,102
Clerk of the peace	877
Conveyance of prisoners before trial	1,134
Vagrants, apprehending and conveying	110
Coroner	461
Payment of principal and interest of debt	5,000
Miscellaneous	2,400
Total	£25,872

The county-rate levied at different periods, and the principal disbursements, are shown in the following table:—

	1801.	1811.	1821.	1831.	1838.
	£	£	£	£	£
Income	13,702	9,589	21,116	29,689	17,018
Expenditure:—					
Bridges	24.	658	959	719	757
Gaols	3,723	301	8,874	3,599	656
Prisoners' maintenance	3,082	1,984	6,490	12,489	10,641
Prosecutions	434	338	9,835	3,046	2,541
Constables and vagrants	211	161	811	241	113

The length of streets and highways, and the expenditure thereon, were as under in 1839:—

		Miles.
Streets and roads repaired under local acts		96
Turnpike roads		289
All other highways		1,429
		1,814
Amount of rates levied . . .		£34,432
Expended in repairs of highways	£34,325	
Law and other expenses .	293	
Total expenditure		34,619

The number of turnpike trusts in 1839 was 21; income from tolls, 60,283*l.*; from parish compositions, in lieu of statute duty, 105*l.*; and the total income was 61,000*l.*, the total expenditure for the same year being 63,578*l.* The assets, including arrears of income, amounted to 7,392*l.*; the debts to 202,840*l.* In 1836 the debt was equal to 2·9 years of the annual income;—the proportion for England being 4½ years; the proportion of unpaid interest to the total debt was 17 per cent., the average for England being 12 per cent.

In 1839 the church-rates amounted to 16,526*l.*; and 4,141*l.* applicable to the same objects was derived from other sources. In 1832 the sum derived from 'other sources' included 898*l.* from estates and rent charges. The sum expended for the purposes of the Establishment amounted to 19,772*l.* in 1839, out of which 6,812*l.* was expended on repairs of churches.

Crime.—Number of persons charged with criminal offences in the septennial periods ending 1819, 1826, 1833, and 1840:—

	1813-19.	1820-26.	1827-33.	1834-40.
Total . .	2,829	3,925	5,293	6,892
Annual average .	404	560	756	984

The numbers committed, convicted, and acquitted in each year from 1834 to 1840 were as under:—

	1834.	1835.	1836.	1837.	1838.	1839.	1840.
Committed	1,049	1,007	984	950	898	1,016	988
Acquitted	318	332	314	305	232	273	266
Convicted	731	675	670	645	666	743	722

In 1834 the proportion of persons committed, to the total population of the county, was 1 in 461; and in 1840, allowing for the increase of population, 1 in about 492: showing a decrease, which may be partly attributed to the most populous parts of the county being comprised within the limits of the metropolitan police, over which also the jurisdiction of the Central Criminal Court extends.

Of 988 criminal offenders tried at the assizes and sessions in 1840, there were 67 charged with offences against the person; 45 with offences against property committed with violence; 824 (including 585 cases of simple larceny) with offences against property committed without violence; 6 with malicious offences against property; 27 for forgery and uttering base coin; and 19 for various misdemeanors. About eighty-three per cent. of the offences were those against property committed without violence; and about fifty-nine per cent. were cases of petty larceny. Sentence of death was not recorded in a single case. Of 722 offenders convicted, 11 were transported for life; 25 for periods varying from 10 to 15 years; 40 from 7 to 10 years; 94 for 7 years—making in all 170 offenders transported; 3 were imprisoned for a term exceeding 12 months; 69 for above 6 months; and 449 for 6 months and under; and 31 were whipped, fined, or discharged on sureties. The acquittals were 265 in number; in 4 cases there was no prosecution; in 76 no bill was found; and 185 persons were found not guilty on trial. Of the total number committed, 750 were males and 238 females: 227 males and 93 females could neither read nor write; 388 males and 132 females could read, or read and write imperfectly; 125 males and 12 females could read and write well; 5 had received superior instruction; and the state of instruction of 5 males and 1 female was not ascertained. On an average of several years the proportion of uninstructed criminals in the county was 86·1 per cent.; those instructed 13·9 per cent.;—the average of the former for England and Wales being 89·3 per cent.

Savings Banks.—There are 20 of these institutions; and the number of depositors and amount of deposits on the 20th of November in each of the following years was as under:—

	1833.	1836.	1837.	1838.	1839.	1840.
No. of depositors	15,130	18,613	19,804	21,700	23,316	24,643
Am. of deposits	£395,313	£480,265	£498,177	£544,528	£574,143	£596,634

The distribution of the sums invested in 1830, 1834, and 1839, on the 20th of November in each year, was as under:—

	1830.		1834.		1839.	
	Depositors.	Deposits.	Depositors.	Deposits.	Depositors.	Deposits.
Not exceeding £20	7,781	£ 52,021	9,750	£ 62,706	14,531	£88,849
,, 50	3,328	101,409	3,876	120,292	5,389	163,054
,, 100	1,474	100,782	1,639	113,552	2,237	154,723
,, 150	525	62,839	552	66,664	721	96,997
,, 200	230	38,993	245	41,747	378	65,350
Above . . 200	101	23,964	74	18,543	60	15,170
	13,389	380,060	16,136	423,434	23,316	574,143

The deposits of 160 friendly societies, not reckoned above, amounted, in 1840, to 21,027*l.*; and 11,437*l.* were invested by 161 charitable institutions.

The state of the elective franchise in 1839-40 is shown in the following table:—

	E. div.	W. div.	Total.
Freeholders of every class . .	4,073	2,429	6,502
Copyholders and customary tenants	291	475	766
Leaseholders for life or for a term	572	88	660
50*l.* tenants at will . . .	1,067	593	1,660
Trustees and mortgagees .	43	10	53
Qualified by offices . . .	32	52	84
Joint and duplicate qualifications	68	34	102
	6,146	3,681	9,827

Education.—Summary of the Returns made to Parliament in 1833:—

	Schools.	Scholars.	Total.
Infant-schools . . .	114		
Number of children at such schools; ages from 2 to 7 years:—			
Males . .		1,390	
Females . .		1,310	
Sex not specified .		1,584	
			4,284
Daily-schools . .	1,093		
Number of children at such schools; ages from 4 to 14 years:—			
Males . .		21,970	
Females . .		16,334	
Sex not specified .		3,321	
			41,631
Schools . .	1,207		
Total of children under daily instruction . . .			45,915
Sunday-schools . . .	244		
Number of children at such schools; ages from 4 to 15 years:—			
Males . .		9,912	
Females . .		10,224	
Sex not specified .		2,400	
			22,536

The Schools established by Dissenters, included in the above table, are—

			Scholars.
Infant-schools	2, containing		218
Daily-schools	20	.	1,928
Sunday-schools	63	.	9,208

The schools established since 1818 are—

Infant and other daily schools .	811, containing		28,517
Sunday-schools . .	173	.	13,936

Lending libraries were attached to 64 schools in 1833.

Maintenance of Schools.

Description of schools.	By endowment.		By subscription		By payments from scholars.		Subscrip. and payment from scholars.	
	Schls.	Scholars.	Schls.	Scholars.	Schls.	Scholars.	Schls.	Scholars.
Infant Schools	..	..	9	568	69	953	36	2,763
Daily Schools	66	6195	93	8,785	833	19,912	101	6,739
Sunday Schools	10	705	206	20,078	..	..	28	1,753
Total...	76	6900	306	29,431	902	20,865	165	11,255

The income of endowed schools is 5547*l.*, and a sum of 1049*l.* is applicable for educational purposes in schools not endowed. (*Charity Reports.*)

Only two Sunday-schools were returned from places where no other schools existed. Sixty-one schools, attended by 5385 children, were both Sunday and daily schools. Tak-

ing the numbers returned under daily instruction (45,915), and those attending Sunday-schools (22,536), the total number of children is 68,451, which scarcely exceeds one-half of the total number of children between the ages of 2 and 15. The number of boarding-schools was 182.

SURREY, EARL OF. [HOWARD.]

SURROGATE is, according to Cowell's 'Interpreter,' 'one that is substituted or appointed in the room of another, most commonly of a bishop or a bishop's chancellor.'

The qualifications required in persons appointed as surrogates are defined and enforced by the canons of 1603. The 128th canon declares that no chancellor, commissary, archdeacon, official, or any person using ecclesiastical jurisdiction, shall substitute any person to keep any court for them except he be a grave minister and a graduate or a licensed preacher and beneficed, or a batchelor of law or a master of arts, well qualified from his religion and learning, upon pain of suspension from execution of their offices during three months for each offence. And the person undertaking the office without being so qualified is declared subject to the same censure. (Gibs., *Cod.*, tit. xliii., c. 3.)

Surrogates being delegated officers, their jurisdiction of course depends upon that of the person for whom they act. The principal duty however of ecclesiastical surrogates may be stated to consist of granting probates to wills, letters of administration to the effects of intestates, and marriage licences. The proper performance of these duties is guarded by particular enactments. By the 92nd of the Canons of 1603, surrogates of inferior courts allowing persons to be vexatiously proceeded against in their courts, respecting the probate of wills which ought to be proved in another court, are to be suspended, and to pay the aggrieved party all expenses incurred through such proceedings. By the 93rd canon, any surrogate of the Prerogative Court vexatiously citing a person into his court on the same pretext is to pay the party so cited his costs, upon pain of suspension. (Gibs., *Cod.*, tit. xxiv., c. 4.) By the 26 Geo. II., c. 33, § 7, every surrogate deputed by any ecclesiastical judge who has power to grant licences of marriage is required, before granting any such licence, to take an oath before such judge and to give a bond of 100*l.* to the bishop of the diocese for the faithful execution of his office.

Surrogates are also persons appointed to execute the offices of judges in the courts of Vice-Admiralty in the Colonies, in the place of the regular judges of those courts. The acts of such surrogates have, by the 56th Geo. III., c. 82, the same effect and character as the acts of the regular judges.

SURVEYING is the art of determining the form and dimensions of tracts of ground, the plans of towns and single houses, the courses of roads and rivers, with the boundaries of estates, fields, &c. A survey is accompanied by a representation on paper of all the above-mentioned objects, and frequently by a delineation of the slopes of the hills, as the whole would appear if projected on a horizontal plane. When canals or railways are to be executed, a survey of the ground is combined with the operations of levelling, in order to obtain, besides a horizontal plan, the forms of vertical sections of the ground along the proposed lines, and thus to ascertain the quantities of earth to be removed.

In maritime surveying, the forms of coasts and harbours, the entrances of rivers, with the positions of islands, rocks, and shoals, are to be determined; also the soundings or depths of water in as many different places as possible. [SOUNDINGS.]

Military surveying consists chiefly in representing on paper the features of a country, such as the roads, rivers, hills, and marshes, in order to ascertain the positions which may be occupied as fields of battle or as quarters; and the facilities which the country may afford for the march of troops or the passage of artillery and stores.

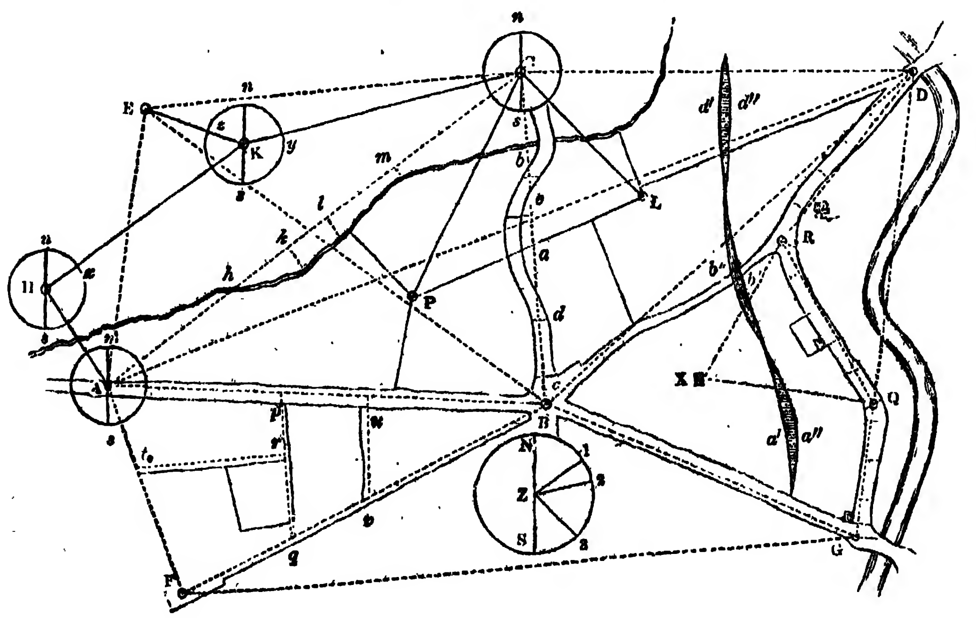
For trigonometrical surveying, see TRIGONOMETRY.

Since the measurement of the distance between two objects by means of a rod or chain is very laborious and inaccurate when that distance is considerable, particularly if the ground has many equalities of level, and is much intersected by walls, hedges, and streams of water, it will seldom be possible to execute even an ordinary survey by such means alone, and instruments for taking angles must be employed, together with the chain, in every operation of importance.

If within the tract to be surveyed there should be a road about half a mile in extent, and nearly straight and level, so that a line may be accurately measured upon it by the chain, and that from its extremities several remarkable objects, as churches or mills, may be seen, it will be convenient to use such measured line as a base, and with a theodolite to observe the angles contained between the base and the lines joining its extremities to the different objects. The three angles of each triangle formed by such lines should if possible be observed, in order that by the agreement of their sum with 180° the accuracy of the angular measurements may be tested; and then the lengths of the sides of the triangles may be determined by the rules of plane trigonometry.

Let AB represent a base so measured in a road; and let C, D, E, F be four remarkable objects within or near the boundaries of the tract to be surveyed; the distances AC, AD, &c., BD, BC, &c. will be those which should be determined by computation. These lines may then serve as bases, and if from their extremities be taken the angles contained between them and lines supposed to connect them with any other objects, as houses or remarkable trees, the positions and distances of these objects may be determined by computation as before. Thus BC or BD will serve as a base by which the position of G may be computed.

It will obviously be advantageous if lines supposed to



connect the objects lie nearly parallel to the directions of roads, lanes, streams, or hedges, on account of the facility which will thereby be afforded for laying down such roads, &c. on the plan. In order that it may be possible to place the theodolite at the angular points of the triangles, those points should not be precisely in the churches, mills, or other objects whose positions are to be determined, but should be indicated by poles set up near those objects, on spots of ground in such situations that each may be visible from the two others which with it constitute the intended triangle. The place of the building may be ascertained by its bearing and distance from the pole in its vicinity. After as many stations as may be thought fit have been determined in the manner just described, and the lengths of the lines (that is, the sides of the triangles) connecting them have been computed, the survey may be completed by actual admeasurements with the chain, in each triangle separately.

Poles having been set up at the angular points of every triangle, the surveyor and his assistant set out from any one of these points, as B, and proceeding across the ground, measure the whole length of any one line, as BC, leaving pickets in the ground in the direction of the line at or near every place where it crosses a hedge, as at *a*, a stream, as at *b*, a road, or any other object which is to be introduced in the plan. Should it happen that the line BC, or any part of it, coincides with the direction of a road, offsets, as they are called, are measured perpendicularly to the line, on one or both sides of it, in order to express the distance from the line to the sides of the road, or to the hedges or walls along those sides; these offsets (which are shown at *c*, *d*, and *e*) should be measured at the end of every chain's length, and particularly at every point in the station line opposite to which there is a remarkable object, as a house, a gate, or merely a bend in the direction of the road. Thus, when the work is laid down on paper, the precise form and breadth of the road will be expressed.

In like manner the other side, AC, of the triangle, is to be measured with the chain; pickets are to be left in the ground at or near every place where a stream, as at *h*, a road, or a hedge crosses the side of the triangle; and offsets, as at *k*, *l*, *m*, are to be measured from the station-line to and across such boundaries as may be nearly parallel to any part of its direction. The like process is to be followed on each side of every triangle: the measured lengths of the sides of each triangle should then be compared with the computed lengths; and if the difference is not considerable, the work may be considered as having been performed with sufficient accuracy; otherwise the operations must be repeated, in order that the source of the error may be detected.

To carry on the work in the interior of any triangle, as ABF, the surveyor, where it is possible, measures with the chain the direct distance from the pickets in one side of the triangle to the pickets in another side, as *uv*, *pq*; and since these pickets are supposed to have been placed near the intersections of boundary-lines (roads, streams, or hedges) with the sides of the triangle, the lines last measured will, at least in part of their length, coincide with or be parallel to some of the boundaries in the interior of the triangle; and the precise figures of such boundaries will be determined as before by offsets from the measured line to all the principal bends. The length of each of these secondary station lines may be obtained by trigonometry, since the line is the base of a secondary triangle of which the two sides are known, being measured parts of two sides of the principal triangle, and the angle included between those sides has been found by the theodolite; therefore the measured length of this line, on being compared with the computed length, will afford an additional test of the accuracy of the work.

In measuring these secondary lines within each principal triangle, pickets must, as before, be left in the ground in the direction of the line, at or near places, as at *r*, where hedges, walls, &c. cross the line; and from one of these pickets, *r*, to another, as *t*, lines are afterwards to be measured (these being as much as possible in or near the direction of other boundaries), till at length the whole interior of each principal triangle will have been divided into several secondary triangles, all the sides of which have been measured. These sides, by means of the offsets which have been measured from them, determine the figures of all the natural and artificial boundaries within the tract of ground.

The situations of the buildings are also determined by offsets from the station-lines nearest to them: the ground-plans of the more considerable edifices, as churches and mansions, are measured, and the directions of their fronts with respect to the meridian are ascertained by a compass or otherwise.

When rivers or roads have many abrupt and deep bends, the determination of their forms by means of offsets from the station-lines may become impracticable; and then a separate survey of such details must be made by means of the compass, the circumferentor, or the theodolite. [THEODOLITE.] The same means must be employed for the survey of a sea-coast, when the operation is to be performed on land; and it may often be advantageous to determine in like manner the forms of the hedges, walls, &c. in the interior of the tract which is to be surveyed. Ground covered with wood must be surveyed by going quite round it; poles being set up at remarkable bends on the contour, the distances between them are measured with the chain, and the bearings of the several lines from the meridian are observed with the theodolite.

In order to explain the process of surveying with the theodolite by the method which is commonly called that of the 'back-angle,' and which is now almost constantly adopted, let it be required to determine the outline HKCLBA, which may represent the contour of a wood, or of which part may coincide with the course of a road or river. The instrument may be set up at H, which may be supposed to be the first station; and let the line *ns* at each of the stations H, K, C, &c. represent the position of the needle or of the magnetic meridian at the station: also let the instrument be adjusted so that the zero point of the horizontal limb may be under the point *n* (the north point of the needle), or the zero of the degrees in the compass-box may be in coincidence with *n*; and let K be the second station. Turn the upper horizontal plate with the telescope till the object-glass of the latter is directed to K, and make the intersection of the wires appear to coincide with the object at that station: then the index of the vernier will be at some graduation on the lower horizontal plate, as at *x*, and the angle *n*HK is that which is observed: suppose it to be 54°, reckoning from the north towards the east, which angle is usually represented by N. 54° E. [N. B. Previously to directing the object-glass to K, it might have been directed to any other visible objects, as F or D, whose positions it might be required to determine by means of their bearings from the meridian line.]

Let the theodolite be now removed to K, a staff being planted in the ground at H: turn the whole instrument round on its vertical axis (the index of the vernier remaining at the graduation N. 54° E) till the object-glass of the telescope is directed to H, and the intersection of the wires appears to coincide with the staff there. Then, if the former angle were correctly taken, and no movement of the horizontal plates on one another have taken place, the south point *s* of the needle will lie over the zero of the graduations on the lower plate, or will coincide with the zero of the degrees in the compass-box; and this circumstance will be a proof of the accuracy of the work, all the meridian lines *ns*, *ns*, being supposed to be parallel to one another.

Now turn the upper horizontal plate with the telescope, till the object-glass of the latter is directed to C, and the intersection of the wires appears to coincide with the object there: the telescope in moving from the position KH to the position KC having passed over and beyond *s*; and the index of the vernier being supposed to be at *y*, the number of the graduation, these being read from *s* in the direction *sny*, will be greater than 180: let it be 256 (or 180°+76°); in that case the observed angle is N. 76° E., and it expresses the bearing of the line KC from the meridian *n*K*s*, or from the meridian *n*H*s*. If the telescope in moving from KH should be directed to an object at E, then, the index of the vernier being supposed to be at *z*, the number of the graduation will be less than 180: let it be 110 (or 180° − 70°); in that case the observed angle is N. 70° W., and it expresses the bearing of the line KE from the meridian *n*K*s* or *n*H*s*.

Let the theodolite be removed to C, a staff being left at K, and turn the whole instrument, the index of the vernier remaining at N. 76° E., till the object-glass of the telescope is directed to K, and the intersection of the wires appears to coincide with the staff there; then the point *n* of the needle should lie over the zero of the graduations. Now turn the upper horizontal plate till the object-glass of the telescope

is directed to L, and the intersection of the wires appears to coincide with the object there: then the telescope, in turning from the position CK to CL, passing over and beyond *s*, the number of the graduation coincident with the index of the vernier will (reckoning from zero at *n*) be less than 180; let it be 133°: in that case the observed angle is N. 133° E., or S. 47° E., and it expresses the bearing of the line CL from the meridian *n*C*s* or *n*H*s*. If the telescope should not pass beyond *s*, and should be in the position CP, for example, the number of the graduation, reckoned from *n*, will be greater than 180; let it be 206, or 180°+26°: in that case the observed angle is S. 26° W., or N. 206° E., or N. 154° W., and it expresses the bearing of the line CP from *n*C*s* or *n*H*s*. In this manner the process of the survey is continued to the end of the road, or till, having passed completely round the wood, the instrument returns to H, from whence it set out.

As, from local attractions or other causes, the polarity of the needle may not be constant, it is scarcely to be expected that the needle should, when the telescope is directed back to a preceding station, be exactly coincident with the north and south line in the compass-box; yet a near approach to such coincidence will serve to detect the existence of considerable errors in the observed angles; and a complete verification of the whole series of operations will be obtained, should the observed bearing of H from the meridian line *n*A*s* at the last station A, that is, the angle *n*AH, be found to agree with the observed bearing of A from the meridian line *n*H*s* at the first station H. When this agreement takes place the work is said to close accurately.

The survey of a road or an enclosure, by following the course of the former, or the contour of the latter, may be performed by simply observing with a surveying-compass or a circumferentor the bearings of the several station-lines from the magnetic meridian, and measuring their lengths; and one of these instruments is generally employed when great accuracy is not required.

The plane table, which is also occasionally employed for surveying ground, is a square board fitted upon a tripod-stand and furnished with a compass, and with an *alidade*, or ruler carrying 'sights' at the extremities. Drawing-paper is made fast to the board or table, and the instrument being set up at any part of the ground which may be thought convenient, a point is marked on the paper to represent the place. The alidade is next turned about that point, so that the line of the sights may be directed to any remarkable objects whose situations are to be determined, and lines are drawn by the edge of the ruler in its several positions; then the distance from the instrument to some one of those objects being measured, and laid down on its line of direction by a convenient scale, the place of that object on the paper is obtained. The table is then removed to that object, and fixed by the needle in the compass-box, so that its edges may be parallel to their former positions; that is, till the alidade placed on the line joining the places of the two objects on the paper is in a direction tending to the former place of the instrument. In this position, the alidade being turned about the point which represents the actual place of the instrument on the ground, lines are drawn as before along the edge of the ruler, towards the several objects which had been observed at the preceding station: the intersections of these lines with the others will determine the places of the objects on the paper.

The length of every line which is to be measured must be obtained in a direction parallel to the horizon between its extremities; and the determination of this length is generally a work of considerable difficulty on account of the inequalities of the ground.

Where great precision is required, it would be proper that the direction of the line to be measured should be indicated by pickets previously planted at intervals along it; a cord may be stretched tight between the two first pickets, and the measurement may be performed by means of a graduated deal-rod 15 or 20 feet in length, which should be applied successively to the cord, the place of each extremity of the rod being marked by a pin pressed into the cord. But when the ground is nearly level, a measuring-chain [CHAIN] is laid upon the ground itself in the direction of the line to be measured, the leading man pressing into the ground, at the end of each chain's length, an iron-pin, which being taken up by the person who follows, the number of pins so taken up serves to show the number of chains in the length of the line measured. In ascending or descending any gentle elevation of the ground, the chain should be held up at the lower end till it is in a horizontal position, as nearly as the chain-holder can estimate it; and a plummet being suspended from that extremity so as to touch the ground vertically under it, the measurement thus obtained is in general sufficiently near the required horizontal length of the line. When the slope of the ground is too great to admit of this simple method being put in practice, the chain must be stretched on the ground, and then the angle at which it is inclined to the horizon being found by some instrument (a small spirit-level furnished with a graduated arc), the horizontal value of the chain's length must be computed. And if, at the same time, the vertical height of one end of the chain above the other be also computed, there will be afforded sufficient data for determining on paper the form of a vertical section of the ground in the direction of the measured line.

Where the rise or fall of the ground is considerable, the operation will be most conveniently and accurately performed by the use of a theodolite; for this purpose pickets should be set up in the ground, in the direction of the line to be measured, at every place where a change occurs in the inclination of the ground to the horizon, and marks made on them at heights above the ground equal to that of the telescope belonging to the theodolite; then, while the chainmen are employed in measuring the length of the line on the ground, the surveyor takes the angular elevations or depressions of the marks on the pickets, with respect to the horizon. From the data thus obtained the horizontal distances between points of ground, and the positions of the points above or below any assumed horizontal plane, can be computed. In order to save the trouble of making trigonometrical computations, the vertical arch of the theodolite usually carries two series of graduations, from which, by inspection, when the telescope is directed to an object, the portion of the measured line which should be subtracted from it in order to reduce it to the corresponding horizontal length may be found; and also the portion of that horizontal length to which the vertical height or depression is equal.

This method may be conveniently put in practice when it is required to exhibit sections of the ground, for the purpose of guiding the civil engineer in the choice of a line for a road or canal; the great accuracy with which the section might be determined by a spirit-level not being requisite. It is now the practice to represent on a plan of the ground a vertical section in the direction of a proposed line of road, for the purpose of showing the depths to which the excavations are to be carried, and the heights to which the embankments are to be raised; a strong line, as a', b', d', representing the surface of the proposed road: on one side of this line, as at a'', d'', are shown the profiles of the requisite excavation; and on the other side, as at b'', are shown the profiles of the embankments: both the heights and depths being determined with relation to the surface of the road. This method was first proposed by Mr. Macneil.

The principal and secondary station-lines constitute a triangulation on the plan of the ground; and when the lengths of these lines have been ascertained by admeasurement, the superfices of the whole track may be found by the rules of mensuration. The area of each triangle should be calculated separately from the measured lengths of the lines, and the several results added together, if all the triangles lie within the given boundaries of the tract: should any of them lie on the exterior of the boundary, the areas must of course be subtracted. But as the boundaries of the several fields, &c. seldom coincide exactly with the station-lines, offsets must have been measured from every such line to each remarkable bend in the nearest boundary; and between the station-line, the boundary, and every two offsets from the former, there exists a small trapezoid, whose area must be computed separately, and either subtracted from or added to the areas of the triangles formed by the measured station-lines, according as it lies within or on the exterior of these triangles.

The accurate method just described is not always put in practice by surveyors. When the boundaries of a field or tract of ground have numerous small bends, a straight line is sometimes drawn through portions of the boundary in such a manner that the small areas on the exterior of the line shall be equal to those which fall in the interior, this equality being estimated by the eye: the complex figure of the contour line is thus reduced to one more simple; and

the area of the field or tract is then computed. For this purpose either the plan is divided into two or more triangles, or by a geometrical construction the whole irregular figure is reduced to one triangle of equal magnitude, and in either case the lengths of the sides are measured by the scale of the plan.

When a road, river, or any boundary-line is surveyed with the theodolite and chain, the successive operations are registered in a book according to a particular form, by which a person without any knowledge of the ground may be enabled with facility to lay the work down on paper. This is called the 'Field-Book,' and the manner of entering in it the series of operations will be best explained by means of an example. Let G, Q, R, D, be the principal bends in the direction of a road, and the stations at which, in succession, the theodolite is placed for the purpose of observing the bearings of the several lines G Q, Q R, and R D, from the magnetic meridian passing through the first station G.

At G let the bearing of the object, or mark set up at Q, be observed; let the line G Q be measured with the chain, and let offsets be measured perpendicularly to that line up to any remarkable points near it. At Q let the bearing of a staff at R be observed; also let the length of Q R, and of several offsets from it at remarkable points towards the right and left hand along that part of the road, be measured. Again at R let the bearing of the staff at D be observed; let also the length of R D, and of various offsets along that line, be measured: and let it be supposed that the like process is continued as far as may be required.

Each page of the field-book is then divided, as below, into three columns by two parallel lines drawn down the page: and beginning at the bottom of the column, the several bearings of objects, the lengths of the station-lines, and the several offsets from those lines are inserted, in order, ascending towards the top of the page, the offsets being placed on the right or left hand of the middle column, conformably to their positions with respect to the station-line to which they belong. And it is on this account that the several entries are made in succession from the bottom upwards. The distances in the middle column between the stations G and Q are reckoned from G; those between Q and R are reckoned from Q, and so on, each number in that column expressing the distance up to the place in the station-line where the offset whose length is given immediately on the right or left hand of the number was taken. When it is required to determine by observed bearings the position of any object, as X, at a distance from the road, those bearings are also inserted in the field-book at the stations, as Q and R, where they were observed, and immediately under the bearing of the next forward station. The mark ⊙ is usually put to signify the word 'station.'

Form of the Field-Book.

	⊙	4, 600	at D, near the bridge.
	30	500	10
45	0	300	
40	10	200	
45	5	100	40 to a tree.
40		0	45 to a gate.
		N. 40° E.	⊙ 4 (D)
House X.		S. 31° W.	
		at ⊙ 3 (R)	
	⊙	3, 500	two roads unite.
	35	400	15
	42	300	10
To a house	30	200	15
	25	100	15
	30	0	25
		N. 30° 20′ W.	⊙ 3 (R)
House X.		N. 82° W.	
		at ⊙ 2 (Q)	
	⊙	2, 350	
	12	300	40
	20	200	32
To hedge by road-side	15	100	30
To a cottage	10	20	50 to side of road.
		0	60 to the river.
		N. 7° E.	
		at ⊙ 1 (G)	near the bridge.

The term 'plotting' is applied to the process of laying down on paper the plan of the ground which has been surveyed. If the survey has been performed by the chain only, the several station-lines constitute the sides of triangles extending over the whole of the ground; the lengths of those sides are determined by admeasurement, and in places where they do not coincide with the roads, hedges, &c., offsets are measured from the sides to the principal bends in those boundaries. In order to 'plot' the survey in this case, a proper scale of graduations, usually representing 'chains' and 'links,' is chosen, and the length of one of the station-lines taken from the scale being laid down on the paper as a base, from the two extremities of it as centres, with distances (taken from the scale) equal to the measured lengths of the two sides, which with the base form the first triangle, arcs are described to intersect one another; this intersection being joined to the extremities of the base by lines, the first triangle is constructed. Each side of this triangle is then used as a base on which another triangle is constructed with lines taken from the scale equal to the measured lengths of the sides, and so on. After the triangulation is thus formed; the offsets are laid down from them. This part of the process is accomplished by setting out with compasses upon each station-line, from one of its extremities, the several distances (taken from the scale) of the points at which the offsets were measured, drawing lines perpendicularly to the station-line at these points, and on them placing, from the scale, the measured lengths of the offsets: lines joining the extremities of these offset lines, either drawn by hand or with a ruler, will represent the lines of roads, the boundaries of fields, and the like. In order to facilitate the operation of laying down the offsets from the station-lines, the surveyor is usually provided with ivory scales graduated to represent chains and links on the edges; by laying an edge of such scale along the station-line, with the zero of the graduations at one end, the several distances of the offset-lines from that extremity can be marked on the line in succession: the scale may then be applied to each offset-line, and the measured extent marked by means of the graduations.

But plotting scales are frequently made with graduations along the edges, and with a short scale, also graduated on an edge, which is disposed at right angles to the length of the principal scale, and is capable of being moved to any part of that scale by having one of its extremities cut so as to slide in a groove formed in the direction of the length of the scale. The perpendicular scale is moved along the principal scale to the graduation which denotes the place of the offset, and the length of the latter is then marked by the graduations on the perpendicular scale. Since the offsets frequently occur on both sides of the station-line, the zero of the graduations on the perpendicular scale may be at some distance from the edge of the principal scale, which is then placed, not in coincidence with the station line, but parallel to it at such a distance that the zero may always be in that line. By this contrivance, which was first proposed by Major Robe, the offsets from the line may be marked, whether they be above or below it, without displacing the principal scale. To find a convenient scale for plotting a survey, the length and breadth of the whole may be computed approximatively in order to ascertain the number of chains in such length or breadth, and then the dimensions of the paper in inches being known, the number of chains in each inch may be formed by proportion. Plans of estates are usually made from scales of 2, 3, or 4 chains in an inch, and the linear dimensions, on a plan made from a scale of 3 chains in an inch, are equal to $\frac{1}{2376}$ of the actual dimensions on the ground.

In important surveys, where the process consists in measuring a base-line and observing with a theodolite the three angles of every triangle, the base is laid down on the paper from some scale as before; and at each of its extremities all the angles contained between the base-line and visual rays from different objects to that extremity are set out by means of a protractor. The intersections of the several lines from the opposite extremities of the base determine the positions of the objects, and form with the base the first triangles. The sides of these triangles become then the bases of other triangles, and the angles observed at the extremities of their sides must be set out by the protractor. If any of these lines have been measured by the chain on the ground, the construction of the triangles by means of the angles may be verified by measuring the lengths of

such lines on the scale by which the base line was laid down. Offsets may also be laid down as already described.

But the practice in ordinary surveys is to observe by the 'back angle,' as before described, the bearings which the different station-lines make with the meridian-line passing through one of the stations, and to measure with the chain the length of each station-line. These bearings and lengths, together with the offsets, are registered in the field-book, and they are generally transferred to the paper in the following manner:—

A line, as N S, is drawn in any convenient part of the paper, generally in a direction parallel to the right and left sides, to represent the magnetic meridian; and any point Z is chosen in it, at which the centre of the protractor is placed. Then the bearings, or angles made with the magnetic meridian by the different station-lines, H K, K C, C L, &c., are set out by the graduations of the protractor about the point so chosen, and lines, as Z 1, Z 2, Z 3, &c., are drawn from this point through the mark made on the paper on setting out each angle. These lines are so numbered in order to indicate the particular station at which each angle was observed. Then if the assumed point Z on the meridian line should be the place of the first station, the first line so drawn is in the direction of the first station-line; but if the assumed point is not the first station, the place of this first station must be chosen on the paper, as a H; and a line drawn through it parallel to Z 1 will be the direction of the first station-line. Its extremity K, found by setting out its length from the plotting scale, will be the place of the second station. Through K a line is to be drawn parallel to Z 2, and this will be the direction of the second station-line, whose length K C must then be set out as before. This process is to be continued till all the station lines have been laid down; when, if the survey has been carried quite round the boundaries of a tract of ground, the second extremity of the last station-line will, provided the operations have been accurately performed, coincide with H, the place of the first station. From these lines the offsets must be set out as before described.

In order to set out the allotments of land in countries which, like some parts of North America, are covered with wood, the surveyor determines on the ground the position of a boundary-line comprehending an area of a square form, each side of which is six or eight miles in length. One of these spaces, which constitutes a township, is usually divided into squares of one mile on each side; and again, these are divided into squares of half or a quarter of a mile on each side.

The boundary-line of the township is determined by measuring with a chain a base-line six or eight miles in length, generally along one side of a square already marked out for some previous township; and at each extremity of this line carrying out one of equal length perpendicularly to the base. A line joining the farthest extremities of the last lines completes the square. In order to mark out the two sides which are perpendicular to the measured base, a circumferentor, or a large surveying-compass, furnished with plain 'sights,' and mounted on a stand, is used. The bearing of the intended line from the magnetic meridian being ascertained from the position of the base, and the instrument being set up at one extremity of that line, the line of the sights is turned so as to make with the needle of the compass an angle equal to that bearing; then the surveyor, looking in the direction of the sights, observes some remarkable tree, and causes the distance from his station to that tree to be measured, small trees, if such there be between himself and the object, being cut down. Notches are cut in the tree in order that it may be distinguished from the others, and the instrument is removed to the opposite side of the tree. The line of the sights is then turned so as to make the given angle with the needle, and the distance of the station to the next remarkable tree in the line is measured as before. This process is continued to the extremity of the line which is to be set out, and strong stakes are planted at the end of each mile, half mile, and quarter mile on the line. From these stakes the lines of division and subdivision are carried out in a similar manner.

When the allotments are contiguous to a road, or the bank of a river, a narrow front is measured along the road or river, and the boundary-lines are carried out, perpendicularly to the front, as far as may be requisite in order to comprehend between them the intended area.

SURVIVORSHIP. A question of life contingencies is said to be one of survivorship when a benefit depends upon the order of the deaths of individuals in such manner that it shall be necessary to calculate the chance of one individual dying before another in every year of life. This distinctive name depends therefore entirely upon the mathematical character of the problem, and of two questions, which both seem to depend on survivorship in the common sense of the word, one may really do so, in the technical sense, and not the other. Thus, the question of finding the premium of an assurance on the death of A, provided B die first, is one of survivorship: but that of finding the value of an annuity on the life of A, to begin at the death of B, is not.

The *chance of survivorship* is that of one individual, now of a given age, surviving another, also now of a given age. The following table exhibits the chance of the older life surviving the younger, according to the Carlisle Table. Thus the chance that 65 shall survive 25 is ·110; consequently the chance of 25 surviving 65 is 1 − ·110 or ·890: and it is 890 to 110, or about 8 to 1, that of two persons aged 65 and 25, the elder shall die first.

Elder.	Younger.	Chance of elder surviving younger.
15	5	·400
20	10	·383
25	15	·381
30	20	·375
35	25	·372
40	30	·366
45	35	·360
50	40	·350
55	45	·329
60	50	·315
65	55	·323
70	60	·322
75	65	·303
80	70	·320
85	75	·332
90	80	·329
95	85	·462
25	5	·307
30	10	·283
35	15	·279
40	20	·270
45	25	·263
50	30	·251
55	35	·231
60	40	·212
65	45	·194
70	50	·177
75	55	·177
80	60	·190
85	65	·174
90	70	·191
95	75	·300
35	5	·235
40	10	·207
45	15	·202
50	20	·189
55	25	·174
60	30	·158
65	35	·143
70	40	·126
75	45	·104
80	50	·093
85	55	·094
90	60	·113
95	65	·147
45	5	·177
50	10	·146
55	15	·135
60	20	·119
65	25	·110
70	30	·097
75	35	·081
80	40	·075
85	45	·059
90	50	·052
95	55	·078
55	5	·125
60	10	·091
65	15	·085
70	20	·071
75	25	·061
80	30	·056
85	35	·046
90	40	·044
95	45	·019
65	5	·086
70	10	·054
75	15	·048
80	20	·040
85	25	·034
90	30	·033
95	35	·039
75	5	·057
80	10	·028
85	15	·024
90	20	·012
95	25	·029
85	5	·040
90	10	·017
95	15	·023
95	5	·036

SURVIVORSHIP. [JOINT TENANCY.]

SUS. [MAROCCO.]

SUS. [SUSA.]

SUSA (Σοῦσα), the capital of the country called Susiana and Susis by the Greek geographers. It might almost be considered a part of Persis, as Strabo (p. 727, Casaub.) observes, for it lay between Persis and Babylonia. Susiana comprised part of a mountain region, and it extended also to the coast of the Persian Gulf. The length of the sea-coast from the boundary of the sea-coast of Persis to the mouth

of the Tigris was about three thousand stadia. The Choaspes flowed through Susiana, from the mountains of the Uxii, and it entered the Persian Gulf within the limits of the sea-coast of Susiana. Between Susiana and Persis there was a narrow mountain tract, the passes of which were difficult, and were infested by robbers, who even exacted payment of the Persian kings when they passed through the defiles. According to Nearchus the whole coast of Susiana was marshy, and extended westward as far as the mouth of the Euphrates. Besides the Choaspes, there were the rivers Coprates and the Pasitigris, which flowed from the mountains of the Uxii. The Eulaeus is also enumerated among the rivers of Susiana. Such is the substance of Strabo's description of Susiana, which is far from being clear.

The modern Khuzistan, which perhaps comprehends pretty nearly the antient Susiana, lies between 30° and 32° 30′ N. lat., and between 48° and 50° E. long., but it is not intended to say that these parallels and meridians accurately define the limits of the country. From about 31° 30′ N. lat. to 30° the country is flat; north of 31° 30′ it begins to be hilly, and north of 32° the country may be called mountainous. The first great stream, beginning from the west, is the Kerkhah (more usually, but perhaps less correctly, written Kerah), which enters the united streams of the Tigris and Euphrates a little below Kornah, and is identified with the Choaspes. To the east of this river, near 32° N. lat., is the modern Sus. The next stream, to the east, is the Kuran, or Karoon, as it is sometimes written, which joins the Shat-al-Arab by the Hafar cut. This river is formed by two great branches, of which the Dizful, the antient Coprates, is the western, and the Kuran, which flows by Shuster, is the eastern branch. The Dizful and Kuran unite about twenty miles below Shuster; and form the stream antiently called the Pasitigris. The river of Shuster is by some writers identified with the Eulæus, but others consider the Eulæus to be the same as the Choaspes. East of the Kuran is the Jerahi, which likewise flows from the high land, and either enters the Gulf of Persia or is united by a channel with the river of Shuster after its junction with the Dizful river. The Jerahi is supposed, but without any good reason, to be the Hedypnus of Pliny.

In proceeding from Dizful to Sus, and at the distance of 10 miles from Dizful, the great mound of Sus is seen. 'It forms the north-western extremity of a large irregular platform of mounds, which appear to have constituted the fort of the city, while the great tumulus represents the site of the inner citadel: by a rough calculation with the sextant I found the height of the lower platform to be between 80 and 90 feet, and that of the great mound to be 165 feet: the platform, which is square, I estimated to measure two miles and a half. The mound which I paced measured 1100 yards round the base and 850 round the summit. The slope is very steep; so steep indeed as only to admit of ascent by two pathways.' (Major Rawlinson.) Major Rawlinson saw on the mound a slab with a cuneiform inscription of thirty-three lines, three Babylonian sepulchral urns imbedded in the soil, and in another place there was exposed to view, a few feet below the surface, a flooring of brickwork; 'the summit of the mound was thickly strewn with broken pottery, glazed tiles, and kiln-dried bricks. Beyond the elevated platform extend the ruins of the city, probably six or seven miles in circumference: they present the same appearance of irregular mounds, covered with bricks and broken pottery, and here and there the fragment of a shaft is seen projecting through the soil.' (Major Rawlinson.) There is abundance of fine grass about the ruins of Sus and the neighbouring country; and the climate in the middle of March was cool and pleasant. From the summit of the great mound Dizful is distinctly visible, bearing north 38° east. The Kerkhah river is one mile and a half west of the great mound of Sus. A stream called the Abi-shapur rises about 10 miles north of Sus, and flows in a deep narrow channel past the so-called tomb of Daniel, and past the western face of the great mound: it is said to join the Kuran in the neighbourhood of Weis, a considerable distance below the junction of the Dizful river and the river of Shuster. Major Rawlinson could discover no traces of buildings in the interval between the Abi shapur and the Kerkhah. The Abi-shapur is navigable from Sus to its junction with the Kuran, and as its bed is deep and narrow, and nearly on a level with the surface of the plain, it is peculiarly suited for some kinds of navigation. Thus it appears that Sus is really on the east side, not of the Kerkhah (Choaspes), but of a navigable river which flows into the antient Pasitigris, and this circumstance may probably explain some of the confusion that appears in antient writers between the Eulæus and Choaspes. The water of the Abi-shapur is said to be heavy and unwholesome, while that of the Kerkhah is said to be little inferior to that of the Kuran. It thus appears that Sus is the site of an antient city, which it is now generally agreed is the Susa of the Greek writers, once a residence of the kings of Persia. The principal arguments in favour of Sus being the site of Susa, are collected in a paper in the 'London Geographical Journal,' vol. iii., 'On the site of Susa,' by G. Long.

Shuster, which has by some geographers been considered to be the site of Susa, is a comparatively modern city, which was founded by Ardeshir Babegan, or his son Shapur, on the left bank of the Kuran. Shuster is nearly due east of Sus, and the distance is about 55 miles from the road. There are two great bands or dykes at Shuster, constructed for the purpose of furnishing a head or supply of water to the city and the lower country. There are no ruins at Shuster which can be referred to a time prior to the Sassanian dynasty. There is no direct evidence in favour of Shuster being on the site of Susa, which is not equally applicable to Sus, and the direct evidence supplied by the antient writers in favour of Sus, and by the existing ruins, is conclusive in favour of that city, and against Shuster.

There is however a place on the right bank of the Kuran, about 32° N. lat., 50° E. long., which Major Rawlinson calls Susan, which he considers to be the Shushan of Scripture. He admits that the Susa of the Greeks was at Sus, near the Kerkhah or Choaspes. Thus he makes two cities of the name of Susan or Susa. Major Rawlinson did not visit Susan, and his account of the great ruins there is derived from hearsay. If his account of the great ruins at Susan should be confirmed, there can be no doubt of its having been the site of a large city, and the name Susan is a presumption in favour of its being either the Susan of the Scriptures or the Susa of the Greek writers, or both. But if the existence of Sus were unknown, the arguments in favour of Susan representing the Susa of Herodotus or of Strabo would fail, and we should not know where to look for Susa. Susa however is now established at Sus, and the only question is, whether this is not the Shushan of the Scriptures, or if Shustan is another place. Major Rawlinson lays much stress on the identification of the river of Shuster with the Eulaeus, which is apparently the Ulai of the prophet Daniel; and he derives an argument from the fact that Sus is one mile and a half from the Kerkhah, 'but at Susan the river does actually lave the base of the great ruin,' though, as he was not at Susan, it does not appear how he knows this fact. He also considers the expression of Scripture, 'Shushan the palace,' as appearing indicative of a distinction from some other city of the same name. He further derives an argument from Pliny and Ptolemy; but the whole of his discussion of this matter is very unsatisfactory. The only evidence worth noticing is the fact of a large city on the Kuran (if that is really the case) called Susan, (if that fact also is certain). It does not however appear but that this Susan may be a modern city like Shuster. Against this evidence we place the admitted fact of Sus being the Susa of the Greeks and a residence of the Persian kings, and the improbability that there should be two cities of the same name which were royal residences at the same time; and further, that the Susan of the Kuran is not mentioned by that name, at least by the historians of Alexander. The ascertained fact of the Abi-shapur, on which the mound of Sus stands, being a navigable river and joining the Kuran below its junction with the Dizful river, goes a long way towards explaining the confusion between the Eulaeus and Choaspes, which are considered to be the same rivers by most antient writers. The Eulæus may be the Abi-Shapur; and the name Eulæus may have sometimes been given to the Kuran below the junction of the Abi-Shapur. Though much has been done to clear up the geography of Susiana, this matter of the Eulæus and Choaspes still requires further consideration; and the admission of this new Susan into our geographical system must be suspended for the present.

(*London Geographical Journal*, vol. ix., Major Rawlinson's *Notes on a March from Zohâb to Khûzistân*, &c.)

SUSA, a province of the Sardinian territories, on the Italian side of the Alps, which separate it from Savoy on the

north, and from France on the west: it is bounded on the south by the province of Pinerolo, and on the east by that of Turin. A great part of the province of Susa lies on the slope of the great Alpine ridge, which here forms the groups of Mont Cenis and Mont Genèvre, the highest summits of which are more than 11,000 feet above the sea. The Dora Ripuaria, which crosses the province in its length from east to west, rises on Mont Genèvre above the village of Cesanna, descends by Oulx and Exilles into the fine valley of Susa, passes by the town of Susa, and at Avigliana enters the plain of Turin, and joins the Po north of Turin, after a course of between sixty and seventy miles. The valley of Susa is fertile, and produces corn, wine, flax, hemp, and mulberries. The highlands produce abundance of chestnuts, and afford good summer pasture. The great road from Turin to Savoy and France over Mont Cenis ascends the valley of Susa as far as the town of Susa, and then turning off to the northward, climbs the side of the mountain till it reaches the elevated plain with the small lake of Mont Cenis, famous for its trout, where is the boundary between Piedmont and Savoy. Lower down to the eastward, in a deep valley or ravine through which the old road formerly passed, is the village of La Novalesa, with an antient and once wealthy monastery, which is often mentioned in the history of the middle ages. In this monastery was found a chronicle, written by the monks, which gave an account of the early marquises of Susa, and of other baronial families of those obscure times: it is known by the name of the Chronicle of La Novalesa. From the town of Susa, following the ascent of the valley to the westward, is the village of Chiomonte or Chaumont, known for its wines, which are equal, if not superior, to those of Burgundy. Higher up is the village of Exilles, with its old fortress built on a rock above the Dora; and still higher is the village of Oulx, from which a carriage-road leads over Mont Genèvre to Briançon in Dauphiné. From Cesanna a mountain-road leads from the valley of the Dora to that of the Clusone, in the province of Pinerolo. Descending the Dora below Susa is the village of Bussolino, on the high road to Turin, in the neighbourhood of which is a quarry of green marble, commonly called Verde di Susa, and which resembles the verde antico of the antients; and lower down is the town of Avigliana, with 3000 inhabitants, in a very fruitful country, with two small lakes well stocked with fish; and farther down is the town and royal residence of Rivoli, which belongs to the province of Turin. Above Avigliana, and near the town of St. Ambrogio, is the small village of Chiusa, in a defile, mentioned in history as a strong position of the Longobards in their wars with the Franks, which Charlemagne was obliged to turn, not being able to force it. The buildings of the Benedictine abbey of S. Michele della Chiusa, once the richest in Piedmont, but long since suppressed, are on a mountain in the neighbourhood. The population of the province of Susa is reckoned at 68,600, distributed among sixty communes.

(Serristori, *Statistica d'Italia*; Denina, *Quadro dell' alta Italia*; *Calendario Sardo*.)

SUSA, the antient Segusium or Segusio, the head town of the province of Susa, is a bishop's see, and has about 3000 inhabitants. In the cathedral is a monument of Adelaide, marchioness of Susa, from whom the house of Savoy is descended. North of the town is the triumphal arch of white marble raised in honour of Augustus, which is still in pretty good preservation. The frieze is adorned with a basso-rilievo representing a sacrifice. The arch is single, and the opening is 40 feet high and 25 feet wide. It stands across the antient Roman road to Gaul, which was opened by Augustus over Mont Genèvre, and of which the traces are still observable. It forms altogether a striking and characteristic entrance into Italy. The fortress of La Brunetta, cut in the rock by Charles Emmanuel III., king of Sardinia, commanded both the roads of Mont Cenis and Mont Genèvre. It was considered impregnable, but it was destroyed by the French after their invasion of Piedmont in 1796.

The town of Susa is old and ill built, several of the streets are lined with low arcades, and some good houses are seen here and there belonging to the provincial nobility. To a traveller coming from the north the appearance of Susa is striking, for he finds here at once, after having just crossed the Alps, the vegetation, the climate, the architecture, and the manners and features of Italy. The town of Susa has a royal college, a tribunale di prefettura, or provincial judicial court, and some manufactories of leather, gloves, and thread.

(Valéry, *Voyages en Italie*; *Nouveau Guide du Voyageur en Italie*.)

SUSARION (Σουσαρίων), son of Philinus, was a native of the antient village of Tripodiscus, in the territory of Megara. He lived about the time of Solon (about Ol. 50), and the Parian Marbles (*Ep.* 39) call him the inventor of comedy, and seem also to indicate that he gained the prize of comedy then instituted, which consisted of a basket of figs and a jar of wine. But as regards Susarion's invention of comedy the matter is not quite clear. We know indeed that the Megarians were very fond of farcical entertainments, but it is also certain that the invention of real and written comedies belongs to a later time; and there is indeed, as Bentley (*A Dissert. on the Epist. of Phalaris*, p. 144) has shown, no evidence that the four iambic verses of Susarion still extant formed part of a play. It is further probable that he performed his extempore farces upon a waggon, as was customary at the country Dionysia in Attica. The place where he acted his farces was Icarius, a hamlet of Attica, whence some writers call him an Icarian. What is called his invention of comedy must therefore have consisted in introducing into Attica the Doric form of comedy, or he introduced some innovation into these farces, and constructed them on better dramatic principles, which seems to be implied in the statement that he employed a chorus, which had not been the case before. But whatever we may think of his improvements, a considerable time passed from the period in which he acted at Icarius, until comedy experienced real improvement, and was composed on artistic principles.

(Bentley, *A Dissertat. on the Epist. of Phalaris*, p. 144-152; Müller, *Dor.*, iv. 7, § 2; *Hist. of the Lit. of Ant. Greece*, chap. xxvii. § 3.)

SUSIA'NA. [SUSA.]

SUSPENSION is a term used in law when a seignory rent or other profit out of land, by reason of the unity of possession of the seignory, rent, &c., and of the land out of which they issue, are not *in esse* for a time, but may be revived or awaked. It differs from extinguishment, which is when the rent, &c. is gone for ever by reason of the estate in the land being coextensive with that in the rent, &c. (Co. Litt., 313, *a*.)

SUSPENSION, ECCLESIASTICAL, is a mode of censure or secondary punishment inflicted by the church on persons guilty of those minor offences which do not deserve the severer penalties of deprivation or excommunication. 'In the laws of the church,' says Bishop Gibson, 'we read of two sorts of suspension—one relating solely to the clergy, the other extending also to the laity.'

'That which relates solely to the clergy is suspension *ab officio et beneficio* (*i.e.* the duties and income of his office) jointly, or *ab officio* or *beneficio* singly, and may be called a temporary degradation or deprivation, or both.' 'The other, which relates to the laity also, is suspension *ab ingressu ecclesiæ* (*i.e.* from entering the church), or from the hearing of divine service and receiving the holy sacrament, which may therefore be called a *temporary excommunication*.' He also observes that the two sorts of suspension agree in this, that both are inflicted for crimes of an *inferior* nature; that both, in *practice* at least, are temporary; and lastly, both, if unduly performed, are attended with further penalties.' (See Gibs., *Cod.*, tit. xlvi., cap. 3.)

In the Roman Catholic Church various kinds of suspension were inflicted for a great variety of offences. A few may be mentioned to illustrate the nature of this punishment. A bishop might be suspended from wearing the sacred vestments of his order, or from exercising his power of collating, instituting, or presenting to livings, or from the exercise of his jurisdiction, or from his office and benefice, or even from entering the church. These various species of punishment were inflicted for such offences as delaying to consecrate a church after proper application, not punishing concubinary priests, or corrupt and irregular practices in instituting persons to ecclesiastical preferments. The inferior orders of the clergy and other religious persons might be suspended from their office or benefice, or from performing service, or from receiving the sacrament, or from entering the church. The offences so punished were delay or irregularity in the performance of their duties, not wearing a proper dress, violating the rules of their order with respect to eating and drinking, neglecting to receive the sacrament at Easter, or extortion.

Suspension was either imposed by sentence after trial, in

which case it must have been preceded by admonition, or was ipso facto upon the perpetration of certain crimes. (Gibs., *Cod.*, *ubi supra.*)

Suspension has been retained as a mode of punishment in the English church. By the 33rd canon of 1603, a bishop ordaining a person who has not a proper title, and refusing to maintain him till he prefer him to some ecclesiastical living, is to be suspended from giving orders during one year: by the 35th canon, a bishop admitting to sacred orders any one not properly qualified is to be suspended from making either deacons or priests during two years; and by the 36th canon, a bishop ordaining any one who has not subscribed in the manner required by that canon is to be suspended from giving orders during twelve months.

It is also declared by the 68th canon that a minister refusing to christen or to bury shall, except under circumstances particularly specified by the canon, be suspended by the bishop of his diocese from his ministry by the space of three months.

Suspension *ipso facto* is also imposed by the 92nd canon upon all ecclesiastical officers who vexatiously cite persons into different courts for the probate of wills.

The above are the principal cases in which suspension still exists as a form of punishment in the church of England. With respect to the laity, Bishop Gibson observes, that 'although this censure is now disused, as being generally thought no punishment by those that deserve it; yet that it is still a legal censure of the church of England, appears not only from many ancient canons and constitutions in this kingdom, which are still in force; but also from an express Act of Parliament, 5 Edw. VI., c. 4, § 1, which provides, that if any person quarrel, chide, or brawl in any church or churchyard, it shall be lawful to the ordinary of the place to suspend every person so offending: that is to say, if he be a layman, *ab ingressu ecclesiæ*, and if he be a clerk, from the ministration of his office, for so long a time as the said ordinary shall by his discretion think meet and convenient, according to the fault. (Gibs., *Cod.*, *ub. sup.*)

There are only two other instances in which the legislature of this country has resorted to suspension as a method of punishment. By the 36 Edw. III., c. 8, which however has been repealed by the 21 Jas. I., c. 28, stipendiary priests taking, without the bishop's dispensation, more than the salaries specified by the act, were suspended of their office.

The other instance occurs in the act passed at the time of the Revolution, prescribing the oaths to be taken to the new government by the 1 W. and M., sess. 1, c. 8, § 7. Every ecclesiastical person neglecting or refusing to take the oath which declared it unlawful to take arms against the king, and the new oaths of allegiance and supremacy, in the manner directed by the act before the 1st of August next following, was declared and adjudged to be suspended from the execution of his office by the space of six months. This assumption of the power of ecclesiastical censure by the laity gave great offence to the high church party. (Hallam, *Const. Hist.*, vol. iii.)

SUSPENSION-BRIDGE, a bridge in which the weight of the roadway, instead of resting upon arches of masonry, or on a rigid frame-work of wood or iron, is supported by the tension of ropes, chains, or rods.

Though it is only within the last twenty or thirty years that suspension-bridges have been constructed to any considerable extent in this country, such structures are by no means of recent origin. Probably the earliest suspension-bridges of which we have any account are those of the Chinese; one of which, the iron chain-bridge of Junnan, or Yunnan, is supposed to have been erected about A.D. 65, in the reign of the emperor Mingus. Ware, who mentions this bridge in his 'Tracts on Vaults and Bridges,' and refers to Kircher's *China Illustrata* and Ogilby's *China* as his authorities, states that the chord-line is of the length of twenty Chinese perches, or 200 cubits. The chain and rope-bridges of India are noticed under BOOTAN, vol. v., p. 169, and the rope-bridges of South America under BRIDGE, vol. v., p. 412. One of the most remarkable of the latter is the bridge of Apurima, which stretches across the cleft of a mountain and a rapid river, at Andaguailas, on the road between Lima and Cuzco. It is described in Frezier's 'Voyage to the South Sea, and along the coasts of Chili and Peru' (p. 184 of the English edition of 1717, and p. 166 of the original French edition of 1716), as about 120 fathoms long and six feet wide. The ropes are formed of bark, and the platform consists of cross pieces of wood interwoven with them. Similar bridges have been described by other writers, the platform being in many cases attached immediately to the sustaining ropes, and therefore assuming the same form, which is that of a catenarian curve. [CATENARY, vol. vi., p. 368.] In some cases additional strength is obtained by adding other ropes, suspended a few feet above the level of the platform; vertical ropes being extended between these and the platform, so as to bear part of its weight. In many of the situations in which rope-bridges are used, high rocky banks afford facilities for fixing the ends of the ropes; but where this is not the case, they are suspended from an elevated framework of timber, or from trees growing on the banks. If the platform of a bridge constructed in this way be attached immediately to the catenarian ropes or chains, it becomes necessary for passengers to rise to the level of the ends of the catenary, either by a flight of steps or by an inclined road. To avoid this inconvenience, and that of the deflection of the roadway, the upper set of ropes or chains must be made sufficiently strong to bear the whole weight of the platform, which may then be suspended from them by vertical ties of various lengths, so as to be nearly or quite horizontal; and the approaches to the platform must be made through or under the framework which supports the ends of the catenaries. Examples of these various forms exist among the suspension-bridges of South America, China, and India, and a few other places; and from these the transition to the more perfect structures of recent times is easy and natural.

Rope-bridges have long been used in military operations in Europe. Sir Howard Douglas, in his 'Essay on the Principles and Construction of Military Bridges' (second edition, 1832), describes several such structures, and states that one was thrown across the Clain, at the siege of Poitiers, in the time of Charles IX. of France. He refers to Davila's 'Historia delle Guerre Civile di Francia', vol. i., p. 264, for particulars. Rope-bridges were also used by Henry, prince of Orange, in 1631, in an enterprise against Ghent and Bruges; in Italy, in the campaigns of 1742; and on several other occasions. One of the most interesting applications of rope-work in the form of a bridge was made in 1812, at the passage of the Tagus by the British army. The object was to provide a passage over Trajan's bridge at Alcantara, one of the arches of which had been destroyed by the French. The gap was near one hundred feet wide, and one hundred and forty feet deep; and over this a net-work of ropes and timber, which had been prepared, was stretched, its extremities being made fast to the remaining masonry of the piers. In connection with this branch of the subject reference may be made to the portable rope-bridges contrived by C. Shakespear, Esq., postmaster-general at Calcutta; a description and model of which were communicated to the Society of Arts in 1824. The details are fully explained and illustrated in the forty-third volume of the Society's 'Transactions.' The supporting ropes are not, in these bridges, suspended in a catenarian curve, but are extended diagonally from the elevated supports or piers to various points of the platform. Temporary suspension-bridges or piers for landing troops, &c. may be supported by ties or rods radiating from vertical masts. Piers or wharfs of this kind are described by Douglas, who mentions one at the Isle of Bourbon, of which an account was given by Mr. C. Noble, in the 'Oriental Repertory,' vol. ii., p. 125.

Drewry states that we have no account of the existence of iron suspension-bridges in Europe before the middle of the last century, and that the earliest appears to have been a small one built across the river Tees, at an elevation of about sixty feet, two miles above Middleton, for foot-passengers only. It was called Winch Bridge, and is described in the third volume of Hutchinson's 'Antiquities of Durham,' which was published in 1794, and in a paper by Robert Stevenson, in the 'Edinburgh Philosophical Journal' for October, 1821. It is, or was (for we do not know whether it is still in existence), about seventy feet long, and rather more than two feet wide. Stevenson, in a plate accompanying his paper, represents the roadway as supported immediately by the chains, which are stretched into a nearly straight line, and are steadied by inclined ties from the banks below. A hand-rail is added on one side for the protection of the passengers, whose footing was far from steady. Stevenson was unable to ascertain precisely the date of the erection of this bridge, but he believed it to be

about 1741. The first iron suspension-bridge built in America was that constructed in 1796, by Mr. Finlay, across Jacob's Creek, on the road between Union Town and Greenburgh, the length of which was about seventy feet. Mr. Finlay subsequently, in 1801, obtained a patent for the construction of such bridges, and built several in the United States: one of which, over the Schuylkill, was 306 feet long. His specification describes a bridge supported by two chains, which pass over high towers on the banks, and have their ends brought down to the ground, and firmly secured. The deflection of the chains between the towers is equal to one-seventh of the span or chord-line. The platform or roadway rests upon transverse beams or joists, two of which, in the centre of the bridge, rest upon the chains at the point of their greatest deflection, while all the others are suspended from the main chains by vertical suspending chains. Where the vertical chains are attached to one of the horizontal links of the main chains, the connection is effected by simply passing them through the links, and keying them above; but where the vertical chain is attached to one of the vertical links of the main or catenarian chain, it is effected by means of a fork which embraces the vertical link and is keyed above it. In 1807 a scheme was proposed by M. Belu, a French engineer, for crossing the Rhine, between Wesel and Ruderich, by a bridge about 820 feet long, to be supported by a net-work of wrought-iron chains. In 1814 a still more extensive bridge of similar construction was proposed for crossing the Mersey at Runcorn Gap, so as to form a direct communication between Runcorn in Cheshire and Liverpool. Provis, in his account of the Menai Bridge, states that the plan was suggested by Mr. Dumbell, of Warrington, and that, although no design had then been made, an idea had been thrown out of crossing the river by a web of metallic rings. The promoters of the scheme applied to Telford, who, on account of the great width of the stream, the extensive traffic upon it, and the nature of the bottom, coincided in the plan for a suspension-bridge. He therefore made many experiments on the strength of iron, with a view to determining the proper proportions for such a structure, and prepared a design for a bridge with a central opening of one thousand feet span, and two side openings of five hundred feet each. The deflection of the main chains in the central arch or span was to be fifty feet, and the road itself was to deflect twenty feet, so that the longitudinal bars of the roadway, linked together to form chains, might, by their catenarian position, assist in supporting the weight. The main chains were to be suspended in four parallel lines, so as to divide the platform, which was to be thirty feet wide, into two carriage-ways and a central foot-path. This grand design was subsequently abandoned; but it was useful in paving the way for the subsequent adoption of iron suspension-bridges.

A few suspension-bridges of minor importance were erected in Great Britain between the date of this scheme and the construction of the celebrated Menai Bridge. Drewry mentions one across Gala Water, which was made of thin wires, at a cost of only about 40*l*., although its span was one hundred and eleven feet. It was erected in 1816, by a manufacturer named Lees, of Galashiels. Another wire bridge of about the same length was built in 1817, across the Tweed, at King's Meadows, at an expense of 160*l*. The platform was four feet wide, and was sustained by wires radiating from the tops of two cast-iron columns at each end of the bridge. The columns were cast hollow, and within each of them was placed a vertical bar of wrought iron, two inches and a half square, to which the wires were immediately attached. Several other bridges were built upon this principle; which, according to Navier, a French writer on suspension-bridges, was suggested many years before by M. Poyet. The most important circumstance in the history of suspension-bridges during this period was, however, the introduction, by Captain (now Sir) Samuel Brown, of an improved method of constructing chains for suspending the roadway. Chains of the ordinary form, with short links, are very defective in strength; and several difficulties, among which is the great extent of surface exposed to oxidation, attend the use of cables consisting of small rods or wires. The plan adopted by Captain Brown was to form chains of round or flat bars of iron, several feet long, having either welded eyes or drilled holes at each end, and being connected together by short links and bolt-pins. He made a model of his invention as early as 1813, and had designed and made calculations for bridges still earlier, but he did not obtain his patent until 1817. His specification gives dimensions for a bridge of a thousand feet span, in which the deflection of the main chains should be equal to one twenty-fifth part of the chord line, while it was proposed to make the platform rise in a gentle curve, so that the centre might be twenty-five feet higher than the ends. He devised an ingenious mode of removing a defective bar, by means of a temporary link, as long as three ordinary links, which may be applied to the chain in such a manner as to bear the strain, and consequently to render the removal of the intervening links easy and safe. The first extensive bridge erected upon Captain Brown's plan was the Union Bridge, across the Tweed, near Berwick. It was commenced in 1819, and opened for use in July, 1820. The length of the chord-line, between the points of suspension on the tops of the towers, is four hundred and forty-nine feet, and the deflection is about thirty feet. There are twelve suspending chains, arranged in pairs side by side, and in three tiers, one above the other; each chain being formed of round rods, fifteen feet long and two inches in diameter, with welded eyes, connected together by short coupling-links, the length of which is six inches and three-quarters from centre to centre of the bolt-holes. The bolts for connecting the rods and links are keyed at one end, and are of an oval section, two inches and a half in the longest and two inches in the shortest diameter. The suspension-rods are round, an inch in diameter, and are attached alternately to each of the three tiers of chains, by being dovetailed into a cast-iron saddle placed over the joints. The three tiers of chains are about one foot seven inches apart; and the joints are so arranged that, although in each chain they are fifteen feet apart, they, and the rods suspended from them, are only five feet apart in each set of three double chains. The lower ends of the suspension-rods are forked, to receive longitudinal side-bearers three inches deep and seven-eighths of an inch in thickness, beneath which they are keyed; and upon these longitudinal bearers are laid the transverse wooden joists that immediately sustain the roadway, which rises about two feet in the centre between the suspension-towers. In the towers the distance between the tiers of chains is increased to two feet; and the length of the links is reduced, in order that the chains may lie properly upon rollers mounted to receive them. From these rollers the chains are continued obliquely downwards, and their ends are firmly secured in the abutments of the bridge. In 1821 Captain Brown commenced the Trinity suspension-pier at Newhaven, near Edinburgh, which consists of three spans of two hundred and nine feet each, with fourteen feet deflection. In addition to the catenarian chains and vertical suspension-rods, it has diagonal ties from the piers or towers to points upon the platform; and it has, since the erection of the pier, been deemed advisable to add similar ties beneath the platform, to restrain its motion during violent winds. A peculiarity worthy of notice in this structure is the use of stronger connecting-bolts in those parts of the chains which are near the points of suspension than in the centre of the catenaries, where the strain is less severe.

Probably the design above alluded to for crossing the Mersey, and perhaps also that proposed by Telford for a suspended centering for building an iron bridge at the Menai Strait [SCAFFOLDING, vol. xx., p. 499], led to the determination of the Holyhead Road Commissioners, in 1818, to apply to Telford for his opinion respecting the erection of an iron suspension-bridge at the Menai. The history of this great work, which more than any other has tended to the extensive adoption of such structures, has been given in MENAI BRIDGE, vol. xv., p. 91; and a cut of the bridge is given under BRIDGE, vol. v., p. 413. Telford originally proposed to suspend the platform from sixteen chains, or rather cables, each of which was to consist of thirty-six wrought-iron rods, half an inch square. These small rods were to be packed together in a square form, and then segmental pieces were to be added, so that the whole might form a round cable nearly four inches in diameter, which should be secured by bucklings, bound round with small iron wire, and coated with some protecting substance. This plan, with several other details of the original design, was abandoned, and bar-chains resembling those used in the bridges of Captain Brown, excepting in their rectangular section, were adopted. The ordinary link-bars are three inches and a quarter wide or deep, and one inch thick, and their length, with the connecting-plates, is ten feet; but in the subterraneous tunnels in which the ends of the

chains are secured to the rocky shores, the length of the links is reduced to seven feet six inches, and their transverse dimensions are increased to four inches by one inch and a half, so as to diminish the risk of injury by oxidation, which cannot be so readily detected and guarded against as in other parts, owing to the confined situation of the iron-work. The holes for the connecting-bolts were bored by a machine with great care; yet much difficulty was experienced in making them perfectly uniform in distance, since even the small difference in the length of the bars occasioned by changes of temperature became important when they were connected together into chains several hundred feet long. To meet this difficulty each chain was provided with a few adjustable joints, at which, by means of wedges inserted in a slot in the bars, the length might be a little increased or diminished. There are sixteen chains, each of which consists of five lines of bars, connected together at the joints by six coupling-plates. The chains are arranged in four vertical tiers, and form four parallel lines of suspension, the distances between which are regulated by the width of the two carriage-ways and the central foot-path. The chains of the first or uppermost tier are connected with those of the third tier by short vertical rods at the joints, from the lower of which the suspension-rods descend; and the second and fourth chains are connected together in like manner, their joints being intermediate between those of the first and third tiers, so that, although the joints of each chain are ten feet apart, the suspension-rods descend at intervals of only five feet. The suspension-rods are an inch square, and they support transverse cross-bearers, or trussed joists, upon which is laid the platform of fir plank. At the sides of each carriage-way there are longitudinal wheel-guards, or beams of oak, to prevent carriages rolling too much to either side, and thereby injuring the suspension-rods. During the progress of the work, which has been very minutely detailed by Mr. Provis, the resident engineer, every piece of iron was carefully tested, and many plans were tried to prevent the injury of the metal by oxidation. That finally adopted was to clean each piece, after proving its strength, then to heat it until the hand could only just be borne upon it, and while hot to immerse it in linseed oil. After remaining in the oil a few minutes, that the pores might be filled, the bar was taken out and returned to the heating-stove, in which the oil was dried by a moderate heat in three or four hours. The oil was thus converted into a thin coat of hard varnish, which afforded a very complete protection from the atmosphere, although it was very liable to be rubbed off by friction. The whole of the iron-work is protected by painting, which is renewed from time to time, for greater security.

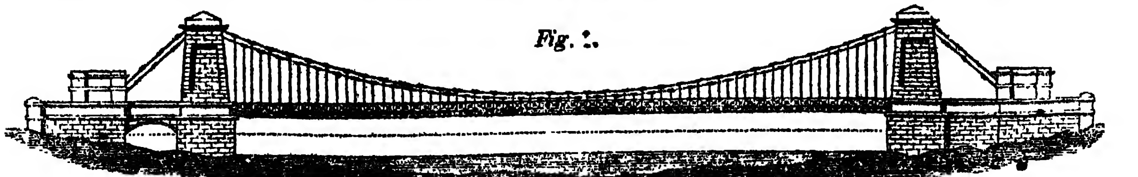
The massive iron castings which are imbedded in the rock to form an abutment for the chains, are bedded upon two or three thicknesses of coarse flannel, saturated with white lead and oil, which, with a few timber wedges, enables them to bear steadily against the rock. The lower ends of the chains, the last or lowest links of which consist of seven instead of five bars, were put together from the abutments, tackle being used to keep them tight, and thereby to prevent their weight from causing them to slide down the inclined tunnels. The portions of chain between the openings of the tunnels and the tops of the piers or towers were built up upon scaffolding; and, to check undulation, they are tied down by rods to the masonry of the end arches (see the cut above referred to), a very little motion being allowed to them on account of changes of temperature. On the tops of the suspension-towers are massive cast-iron saddles to receive the chains; and between these and the cast-iron beds which sustain them are inserted rollers, which allow the saddles to move a little under their immense load, when the chains expand or contract. The operation of raising the portions of chain between the suspension-towers occasioned much anxiety, but was accomplished without great difficulty by joining together several bars from the top of each tower by a hanging scaffold, and elevating the intervening portion of each chain from a raft four hundred feet long and six feet wide, by means of a capstan. In the Conway Bridge, erected by Telford about the same time, the chains were built up, or put together, upon a temporary rope-bridge stretched between the towers.

Before the Menai Bridge was completed, it was found that high winds occasioned considerable vibration, especially in the windward chains. To check this motion transverse braces were applied in such a manner as to tie the several chains together, and to check their individual motion. Each of these braces, of which there are eight in the length of the bridge, consists of cast-iron tubes placed between the chains, with wrought-iron rods passing through them, which are screwed up at the ends. Thus the stiffness of the tubes prevents the chains from coming too near together, while the tension of the rods serves to check any motion in the opposite direction. The tubes which connect the upper and lower tiers of chains are bound together by diagonal braces.

The experience afforded by several violent storms has led to the adoption of some alterations in the details of this magnificent work, the most important of which are the suspension of the trussed beams that support the roadway by only two points, instead of three, as originally constructed, and the insertion of joints in the lower ends of the suspension-rods, just above the platform. By these alterations more play is allowed, and the risk of fracture to the suspending-rods is greatly diminished.

No enumeration of the suspension-bridges erected in this and other countries since the improvements of Captain Brown and the construction of the Menai Bridge can be here attempted. While the Menai Bridge was in progress Captain Brown constructed the suspension-pier at Brighton, which consists of four openings of two hundred and fifty-five feet each, with a deflection of eighteen feet; and Mr. W. Tierney Clark commenced in 1824 the Hammersmith suspension-bridge, the first erected in the vicinity of London. The central opening of the Hammersmith Bridge has a chord-line of four hundred and twenty-two feet, with a deflection of twenty-nine feet six inches; but as the piers are built in the river, and the roadways between them and the shores are suspended from the chains, the total length of roadway supported by the chains is about a hundred and thirty-five feet more than in the Menai Bridge. The width of the bridge is about thirty feet, there being a carriage-way of twenty feet, and two side footpaths of five feet each. There are eight chains, arranged in four double lines, or in two vertical tiers. The chains on each side of the carriage-way consist of six bars each, placed side by side; but the outermost chains, on the outside of the footpaths, consist of three bars each. The bars are eight feet ten inches long between the centres of the bolt-holes, five inches deep, and one inch thick, and the coupling-plates are fifteen inches and a quarter between the bolt-holes, eight inches wide, and one inch thick. The connecting-bolts are two inches and five-eighths in diameter. The suspension-rods are one inch thick, and about five feet apart; and the platform is supported upon double joists of Memel timber, consisting of two pieces twelve inches deep and four inches wide. The lower ends of the rods pass down between the two halves of each joist, and are keyed beneath, upon iron plates or washers. Longitudinal beams are bolted down to the joists on the outside of the footpaths and along each side of the carriage-way, and the platform is stiffened throughout by a strong longitudinal trussing. The ends of the platform, being above the level of the chains, are supported by frame-work resting upon them, instead of resting upon suspension-rods. This bridge was opened for use in 1827. In 1828 Captain Brown commenced a large suspension-bridge over the South Esk, at Montrose, which is represented in the annexed cut. The chord-line is four hundred and thirty-two feet long, and each chain extends a hundred and fifteen feet

Fig. 2.

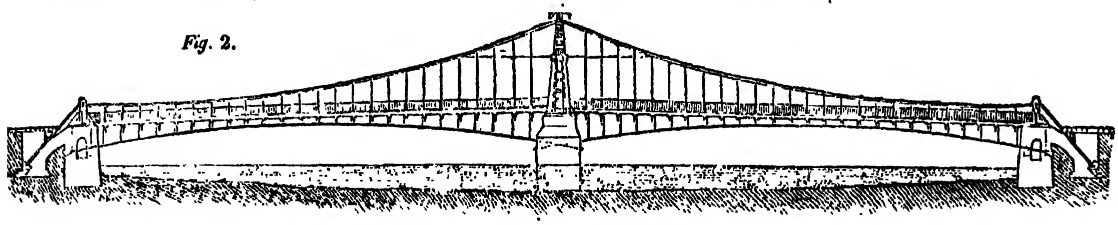


Suspension-Bridge over the South Esk, at Montrose.

from the centre of the tower to the farthest end of the chamber of masonry in which its end is secured. There are two chains on each side of the bridge, one above the other, each consisting of four lines of bars, of the same dimensions as those of the Hammersmith bridge. The total width of the road between the suspension rods is twenty-six feet. This elegant structure was greatly injured in a storm of wind in October, 1838, and has since been considerably strengthened.

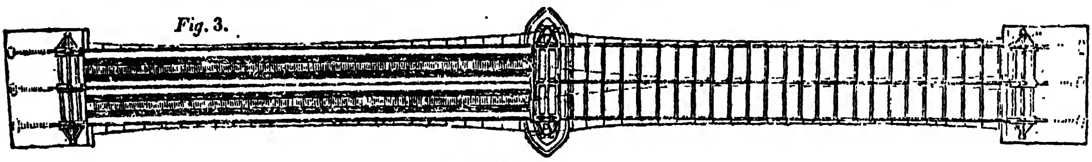
Some suspension-bridges have been erected in which the main-chains, instead of passing over a pier or tower at or near each end of the platform, as in the cut given above, are supported by a single tower in the centre of the bridge, and form what may be called two semi-catenaries. The cut here inserted of a bridge constructed in 1823 by Mr. (now Sir M. I.) Brunel, for the Isle of Bourbon, will illustrate this construction, and also explain the means adopted to enable the bridge to sustain the action of violent winds. The upper figure represents the side elevation of the bridge, showing also the mode of securing the ends of the chains;

Fig. 2.



Suspension-bridge in the Isle of Bourbon.

Fig. 3.



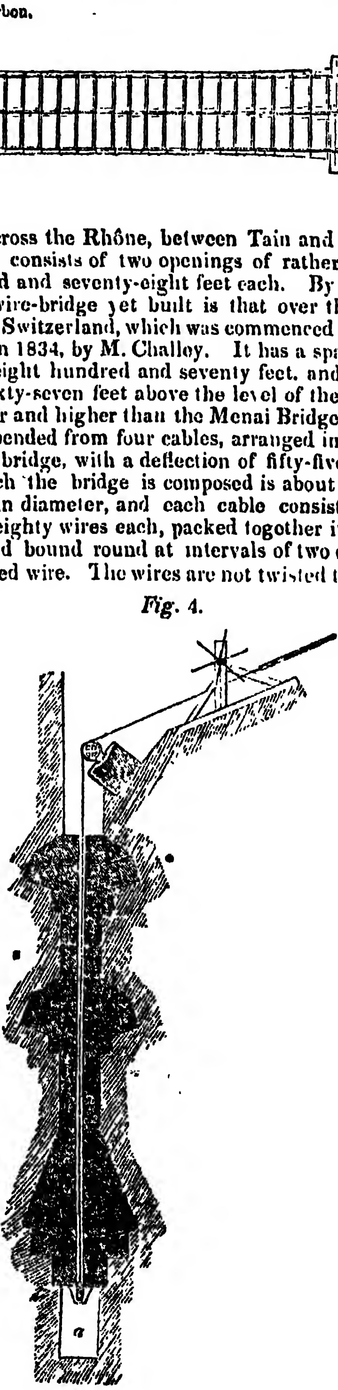
Ground-plan of the above.

and the lower gives a ground-plan, with the platform removed from one-half, to show the joists. The bridge consists of two openings of a hundred and twenty-two feet each; and, to resist the strain occasioned by hurricanes, which often blow upwards as well as sideways, a set of chains is added under each half of the bridge, in the form of an inverted catenary; the vertical rods which connect these chains with the platform serving, in ordinary circumstances, to keep the chains in the required form, and, in case of a rush of wind tending to lift the platform, acting as suspension or tension rods to keep it in its proper place. These supplementary chains are not arranged in vertical planes, but in the form shown in the ground-plan, which enables them to offer some resistance to a transverse strain, such as would be produced by a wind blowing at right angles with the side of the bridge. Similar stay-chains are applied to another bridge, consisting of a single catenary, which was erected by the same engineer at the same time and place; and such have been applied successfully to the Brighton chain-pier and some other suspension-bridges. Another peculiarity in these bridges is the circumstance that the chains do not rest upon saddles or rollers in the suspension-towers, but are suspended by links from a strong frame-work of cast-iron, by which means very free motion is allowed to the extent necessary to allow for changes of temperature. This mode of fixing the chains was adopted in the Broughton suspension-bridge, over the Irwell, near Manchester, which was erected in 1827. The above form of suspension-bridge, with a single central tower, has been adopted in the Pont d'Arcole, at Paris, and in a suspension-bridge recently erected over Kenmare Sound, Ireland, of which a description is given in the 'Civil Engineer and Architect's Journal,' vol. i., p. 315.

Mr. Robert Stevenson, in vol. v. of the 'Edinburgh Philosophical Journal,' proposed to construct suspension-bridges, under some circumstances, without any elevated points of support for the chains, which were to be firmly secured to the abutments of the bridge, and suspended in a catenarian form below the platform, which was to be supported by frame-work built upon, instead of hanging from them. One of the advantages proposed by this arrangement was that the chains might be equally distributed under the width of the platform, whereas in ordinary suspension-bridges they must be so distributed as to leave width between them for carriage-ways. It has been already stated that part of the platform of the Hammersmith bridge is supported above the chains; and Drewry mentions (pp. 95-6) a bridge of one hundred and three feet span on this principle.

Some small bridges of wire have been alluded to already, and Drewry describes several of large dimensions which were erected on the Continent soon after the introduction of suspension-bridges upon an extensive scale in Great Britain. The first large one erected in France was that of Tournon, across the Rhône, between Tain and Tournon, in 1824-5. It consists of two openings of rather more than two hundred and seventy-eight feet each. By far the most important wire-bridge yet built is that over the Sarine, at Fribourg in Switzerland, which was commenced in 1832, and completed in 1834, by M. Challoy. It has a span, from pier to pier, of eight hundred and seventy feet, and is one hundred and sixty-seven feet above the level of the river, being much longer and higher than the Menai Bridge. The platform is suspended from four cables, arranged in pairs at the sides of the bridge, with a deflection of fifty-five feet. The wire of which the bridge is composed is about one-twelfth of an inch in diameter, and each cable consists of fifteen bundles of eighty wires each, packed together in a cylindrical form, and bound round at intervals of two or three feet with annealed wire. The wires are not twisted together like

Fig. 4.



the strands of a rope, but each of them extends straight from end to end of the cable. At the suspension-towers the fifteen bundles of wires which compose each cable are flattened out into a broad strap, to give them a more extensive bearing upon the friction-rollers over which they are conducted; and after passing these rollers, they are again united into a cylindrical form until they reach the points of attachment to the rock, which are one hundred and sixty feet from the towers. The ends of the cables are conducted along inclined tunnels excavated in the rock to the depth of forty-five feet from the level of the road at one end of the bridge, and to twice that depth at the other end. In the tunnels the end of each cable is attached to two others, of about half the size, each of which is conducted, over a friction-roller, down a vertical pit or well excavated in the rock to the depth of forty-five feet, in the form represented in *Fig.* 4. The lower end of each small cable is attached to a piece of iron, *a*, which serves as an anchor; and the bevelled recesses of the excavation are filled up with masonry, as indicated by the dark tint in the cut, so arranged as to resist the enormous strain occasioned by the weight of the bridge. As each main cable has two such points of attachment at each end, there are altogether eight of these fastenings at each end of the bridge. The two pairs of cables are suspended at a distance of thirty feet from each other, but the width between the lower ends of the suspension-rods is only twenty-four feet, so that their position is not quite vertical. These rods are small cables, consisting of thirty wires similar to those of which the cables are composed, and having at their upper end a double hook, which rests upon the two cables, as shown at *bb*, *Fig.* 5, which represents one of the suspension-rods or cables as viewed in two different directions; A being its appearance when viewed in a line with the longitudinal direction of the bridge, and B its appearance when looking across the roadway at right angles with the main cables. At the lower end of each vertical suspender is a loop, *a*, which receives the hook of an iron stirrup that embraces the end of one of the transverse beams which support the roadway. There are one hundred and sixty-three pairs of suspending-rods, at intervals of between four and five feet from each other. *Fig.* 6 is a transverse section of the roadway, which is formed of fir planks, supported by the transverse beams, and is stiffened by a strong oak railing, or diagonal truss, running along the sides of the bridge, and by longitudinal beams firmly bolted to the transverse bearers. The bridge was completed at a cost of 24,000*l*., and was publicly opened on the 19th of October, 1834, on which day upwards of five thousand persons were on it at the same time. A minute description of the work was published in French, from which the particulars of the account in Nos. 279 and 280 of the 'Penny Magazine' are derived. In the former number is given a general view of this remarkable structure, and in the latter are some particulars respecting its construction besides those which are given above.

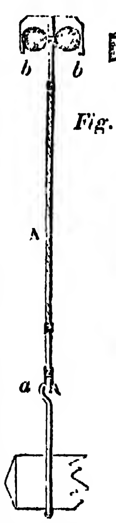
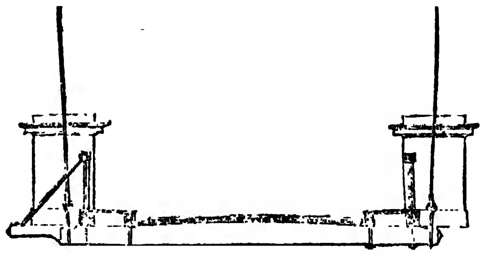


Fig. 5.

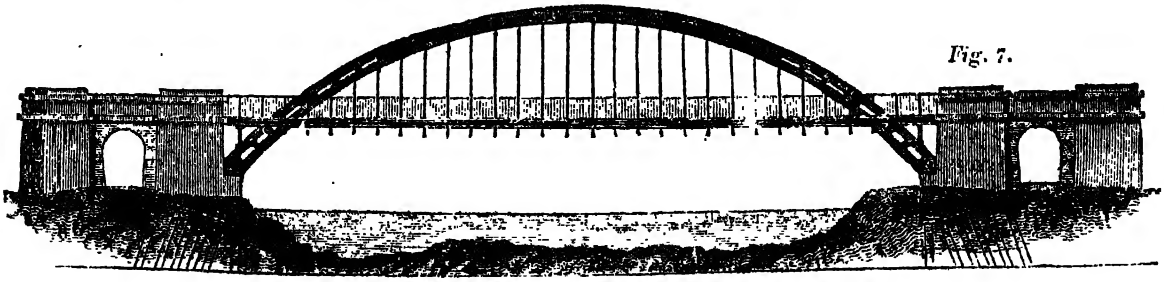
Fig. 6.



The use of wire instead of bar-chains in the construction of suspension-bridges is favoured by the simplicity of the apparatus necessary for their erection, and the superior strength, bulk for bulk, of small wires over bars of considerable dimensions. The increased surface exposed to oxidation forms a serious drawback, since, with every precaution, it is difficult entirely to prevent it, or to detect its progress; and another difficulty, which is perhaps of greater importance, arises from the impossibility of adjusting the length of each wire to its position in the cable, so that, when the cable has assumed its proper curvature, each wire may bear its due proportion of strain. Drewry considers the latter difficulty so great, that he observes that, if wire must be used, it would be better to form it into links of from ten to fifteen feet long, and to couple these together with short links either of wire or of iron, uniting them by transverse bolts of large diameter, which, for the sake of lightness, may be made hollow. He describes (p. 117) a bridge of this description at Geneva, in which both the long and short links may be called skeins of wire, bound round into a cylindrical form in the centre, and spread out into broad loops at the ends, where they embrace the hollow bolts. The structure is, in fact, a chain-bridge, of which the chain-bars and linking-plates consist of bundles of wire, instead of solid bars. He says however (p. 153) that, all things considered, 'it may be safely pronounced that bar-chains are better adapted than wires for anything beyond the size of a foot-bridge.' Many small wire-bridges have been constructed on the radiating system before alluded to, but they are necessarily very subject to vibration, and are consequently unsafe. It is impossible to strain the radiating ties or chains perfectly straight, and yet to leave them sufficiently strong to bear the weight of the bridge; and any inequality in the degree of tension of the different ties may, when the platform is made to vibrate by a load passing over it, or by the action of high winds, occasion strains which no practicable strength will enable them to bear. This plan must therefore be considered inapplicable to any but very small bridges, in which the strength is usually so great in proportion to the strain, as to render defects of construction of but little consequence.

Several suspension-bridges of small span have been constructed upon an ingenious plan which combines the advantages of the opposite principles of tension and compression. The first of these, we believe, was the Monk Bridge, across the river Aire at Leeds, which was erected in 1827, by Mr. George Leather of that place. *Fig.* 7 represents another bridge, of rather larger dimensions, built by the same engineer, at Hunslet, near Leeds, a few years later. The platform is supported by vertical suspension-rods, the

Fig. 7.



Suspension-bridge over the Aire at Hunslet, near Leeds. Scale, one inch to forty feet.

upper ends of which, instead of being attached to catenarian chains, are supported by rigid arches of cast-iron, which, rising between the carriage-way and the footpaths, are elevated above the level of the platform. In the bridge here represented the cast-iron arcs or ribs are of 152 feet span, and each consists of six pieces fitted together. The suspending-rods are of malleable iron, and they sustain transverse cast-iron beams upon which the roadway is laid. The width of the carriage-way is twenty-four feet, and of the footpaths, which are outside the lines of suspension, seven feet

each. Of other bridges on this principle, which combines an unusual degree of stiffness with some of the valuable properties of the ordinary catenarian construction, reference may be made to that erected for the Birmingham, Bristol, and Thames Junction (now called the West London) Railway Company, at Wormwood or Wormholt Scrubbs, over a diversion of the Paddington canal, at the point where the railway itself passes by a tunnel under the canal. This curious bridge, or rather combination of bridges, is described and represented in the 'Companion to the Almanac' for 1840, p. 249. Timber bridges have been constructed on a similar principle to the above, which may be compared to the kind of truss represented in the article ROOF. *Fig.* 18 (vol. xx. p. 146). Drewry mentions one at Eglisau, near Zürich, in Switzerland, consisting of two arches formed of beams 15 feet long, 10 inches broad, and 1 foot deep, with their abutting ends secured by iron straps. The ends of the arches are tied together by horizontal braces, and the weight of the platform is suspended by vertical bars arranged in pairs, which embrace the wooden arch or rib, and are bolted together above it. A similar structure was proposed some years since for crossing the Thames at Hungerford-market, where an iron suspension-bridge for foot passengers is now being erected. Stevenson describes some very extensive bridges of this kind in his 'Sketch of the Civil Engineering of North America.' One, over the Delaware, at Trenton, about thirty miles from Philadelphia, consists of five arches, varying from 160 to 200 feet span; and another, over the Susquehanna, at Columbia, is of twenty-nine arches of 200 feet span.

Much attention has been recently excited by the principle of constructing suspension-bridges introduced by Mr. Dredge of Bath, who obtained a patent for his invention in 1836. Without offering any opinion as to the accuracy of his calculations, it may be briefly stated that he professes to effect such great economy of material by a better disposition of the rods and chains, that it has been asserted (*Civil Engineer and Architect's Journal*, vol. iii., p. 193), that the Menai bridge might, on the new plan, be reconstructed for less than the value of the superfluous metal in the present structure. The leading features of his plan are the adaptation of every part of the chain to the precise amount of strain to which it is exposed, by diminishing the number of plates, and consequently the weight and strength of the chains, from the points of suspension to the lowest or central point of the catenary; and the position of the suspending-rods, which, instead of being vertical, are arranged in oblique lines from their points of attachment to the main chains towards the centre of the catenary. The Victoria bridge, over the Avon, at Bath, which was built on this plan in 1836, contains only twenty-one tons of iron, although it is of 150 feet span. In some experiments tried at the Adelaide Gallery, London, it was found that a small wire-bridge of the ordinary construction, consisting of six ounces and a half of wire, and forming a span of five feet eight inches and a half, broke with the weight of eight persons; while a similar bridge, formed of only six ounces of wire, on Dredge's plan, bore eleven persons, until one of them stamped, when it broke down.

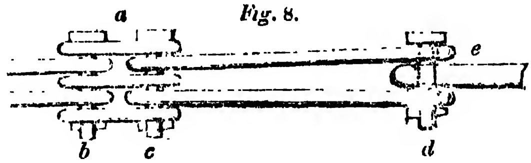
Suspension-bridges are well adapted for many situations in which, from the limited traffic, the expense of ordinary stone bridges would prevent their adoption, and also for places in which, from the great span required, the great elevation, the unfavourable nature of the bottom, or the rapidity of the current to be crossed, the erection of any other kind of bridge would be difficult; but they are not applicable to situations of great and constant traffic, since they are much weaker than arch-bridges, and very liable to injury from the vibration occasioned by what might appear slight forces. It is true that, as urged by some of the advocates of this elegant kind of bridge, the low position of the centre of gravity with relation to the points of support, and the freedom of motion allowed by its flexible structure, enables a suspension-bridge to return to its position of equilibrium after it has been disturbed by any accidental cause; but this circumstance will not always be sufficient to counterbalance its greater liability to disturbance, and the risk of accident from defects of workmanship or of construction. Several accidents having occurred to suspension-bridges through the effect of wind, or the strain occasioned by the passing of a large body of people, whose mere weight might be far from sufficient to account for the failure, engineers have recently devoted much more attention than was formerly deemed necessary to means for checking the undulatory or vibratory motion. Drewry, after observing (p. 27) that in small bridges the mass of materials suspended is usually too small to do much injury if put in motion, says that 'in suspension-bridges of large dimensions, and consequently of great weight, the force that the suspended mass will acquire by being put in motion increases rapidly.' 'Hence,' he proceeds, 'it is an object to make it resist motion, and especially to make every part bear its fair share of strain. It is a common doctrine that lightness is the peculiar excellence of a suspension-bridge; but that is a principle which must be acted upon with discretion, and not taken generally; for a bridge may be, from its size, just so heavy that by being put in motion it will acquire great momentum, and just so light and slight that it will be unable to resist the effects of its own vibration. Therefore, when it becomes necessary to make the chains of a bridge so heavy that vibration would be dangerous, it is advisable boldly to increase their weight, rather than to attempt to diminish it, and to bind and connect the several chains and the roadway firmly together, in order that there may be sufficient *mass and stiffness* in the bridge to *resist* motion, rather than to yield to it readily.' Reversed catenaries, as in the Isle of Bourbon bridges, and lateral guys extending from the platform to fixed points on the shores, may prove very useful in checking motion; but probably the most important measure adopted for this purpose is that of trussing the platform longitudinally by two or more lines of stiff diagonal trusses, which may be made in the form of a handsome railing. This is particularly insisted upon in a paper by Colonel (now General) Pasley, of the Royal Engineers, published in the third volume of the 'Transactions of the Institution of Civil Engineers,' upon the state of the Montrose suspension-bridge, after its injury by the hurricane of October 11th, 1838. He conceives that the injuries to which suspension-bridges are exposed from wind arise chiefly from its action beneath the platform, and, in illustration of his position, observes that in the storm of November, 1836, the roadway of the Brighton chain-pier did not give way until after the side railings were shattered and blown away. He also refers to the Hammersmith bridge, which is trussed throughout, as an illustration of the advantage of the system. It is urged in this paper, that if the platform, which presents a large surface to the wind acting from below, be kept from undulating, 'it can scarcely be supposed that the utmost force of the wind could move the chains at all, having comparatively so very little surface to oppose to it, and which must be held down by the great weight of the roadway, so long as *that* remains at rest.' Mr. Provis agrees with the above writer as to the importance of stiffening the platform, although he conceives the mischievous action of the wind to take place laterally as well as vertically; but, in the Menai bridge, in making repairs after the storm of January 7, 1839, he has preferred obtaining the requisite strength by longitudinal beams, instead of trusses. The Montrose suspension-bridge has been, since the injuries described by Colonel Pasley, strengthened with a system of longitudinal trussing by Mr. Rendel, who read a description of it before the British Association in 1841.

Of the theoretical points involved in the construction of suspension-bridges little will be said. These have been considered at length by Davies Gilbert, Esq., in a paper read before the Royal Society in 1826, and printed in vol. cxvi. of the 'Philosophical Transactions;' and in Drewry's work, referred to at the end of this article. The amount of deflection of the chains between the points of suspension must depend upon circumstances; but Drewry conceives that it is not advisable in a large bridge to make the deflection less than one-fifteenth of the chord-line; and that one-fourteenth or one-thirteenth is a better proportion. Some bridges have a still deeper deflection; and others, for bearing very little weight, have as little as one-twentieth; but this Drewry considers unadvisable, because the great strain thrown upon the chains by drawing them into so flat a curve detracts materially from their effective strength. The angle formed by the descent of the chains upon the land-side of the towers should be either the same as that formed by the commencement of the catenary, or very nearly so, in order that the pressure upon the suspension-towers may be vertical, and may not have any tendency to pull them over in either direction. Douglas observes that there is a slight error on this point in the Menai bridge; the angles formed by the

chains with an horizontal line being, on the outward and inward sides of the pillar, 16° 10′ and 18° 3′ respectively. 'From this inequality,' he says, 'a horizontal force arises, tending to draw the pillars outwards; and though this force be very small compared with the pressure on the pillar, yet acting constantly at the end of a lever of such length as the height of the pillar (nearly 200 feet), it may produce injurious effects.' 'This therefore,' he proceeds, 'is an error in principle, which should have been avoided, and which ought not to exist in any such constructions' (p. 349). This error appears to be a very common one, and is in some cases considerable in extent; but the most common error is that of making the chains deflect too suddenly on the land-side of the piers, so that the strain tends to throw them into the water.

The method of securing the chains to the abutments is of the greatest importance. Where the abutments are of rock, excavations may be readily formed of a suitable shape, and the required security is easily attainable; but when the abutments are of masonry, Douglas recommends that the whole should be so cramped together that the strain may be borne by the whole mass, and not merely by the wedge-shaped portion upon which it more immediately acts. In all cases the lower part of the chains, and the fastenings by which they are secured, should be left accessible for examination. We may here allude to a singular blunder committed in the abutment-fastenings of the Broughton suspension-bridge at Manchester, which appears to have been the principal predisposing cause of its fall, although the unusual strain to which it was exposed at the time was the *immediate* cause of the accident. This bridge, of a hundred and forty-four feet and a half span, was built in 1827, and sustained the traffic without apparent injury until 1831, when it broke under the passage of a body of soldiers, about sixty in number, marching over in fours. Two similar parties had passed just before, but as they were not marching in step, their passage produced no injurious vibration. The roadway was suspended by two double chains, formed of round iron bars two inches in diameter, connected together at the joints by three short elliptical links with cross-bolts, as at *a*, *Fig.* 8. The last joint however, by which the chain

Fig. 8.



was connected with cast-iron discs imbedded in the masonry of the piers, consisted of a single link, *e*, equal in substance to the three small links at *a*; the cross-bolt, *d*, of this joint being only the same size as those marked *b* and *c*. Thus while the bolts *b* and *c*, being exposed to strain near their ends as well as in the middle, could scarcely be made to give way except by being shorn asunder, that at *d*, having no counterbalancing strain at the ends, might easily be bent and broken. Although but one of the bolts was actually broken, they were all found more or less bent. The evil was aggravated by the circular form of the rods, which, as indicated by the dotted lines in the cut, increased the leverage of the strain. This accident, the particulars of which are narrated in the fifth volume of the 'Memoirs of the Literary and Philosophical Society of Manchester,' second series, shows how dangerous it is for a body of men to walk in regular step upon a suspension-bridge; for, with all its defects of construction, the Broughton bridge had sustained far greater weights when applied in a less injurious manner.

Experiments were made some years since by Telford and Captain Brown, to determine the strength which may be safely allowed per square inch for the bars of an iron suspension-bridge. The mean of the results obtained by these engineers is about twenty-seven tons to the square inch, which is commonly taken as the standard for the ultimate or breaking strength of cohesion of good malleable iron. It will stretch with much less, and nine tons per square inch is considered as the maximum strain which it is advisable to allow permanently upon the chains of a suspension-bridge, although a load equal to twelve or fourteen tons may be safely applied for a short time. In 1827-8 a suspension-bridge of *steel* was erected over the Danube at Vienna, by an engineer named Von Mitis, whose preliminary experiments upon various kinds of steel are recorded by Drewry (p. 20). Von Mitis advocates the use of steel in lieu of iron for such structures, but Drewry considers that, if the cost were not a prohibition to its use in this country, its advantages may be questioned, since the greater lightness of a steel suspension-bridge in proportion to its strength would render it more liable to vibration than those of iron. The bridge alluded to at Vienna has a chord line of three hundred and thirty-four English feet, with a deflection of nearly twenty-one feet and a half, and its vibration is said to be considerable. In a paper read before the Institution of Civil Engineers, on April 14, 1840, by Mr. Andrew Burn, upon a proposed suspension bridge over the Haslar Lake at Portsmouth, the use of cast-iron instead of wrought-iron as a material for the chains is suggested; the advantages proposed being economy and diminished risk of oxidation. Suspension-bridges have been built with wooden chains, formed of long bars linked together. Ware mentions several such bridges on the continent of Europe; and Drewry (p. 154, &c.) describes some plans for the erection of such structures.

Engineers differ in opinion as to the best arrangement of the material of the main-chains; some using several small chains, arranged in four lines, and in two, three, or four tiers, while others think it better to concentrate the whole strength in two chains only. The latter principle is advocated by Mr. I. K. Brunel, on account of the difficulty of providing for the unequal expansion and contraction of the different chains. When only two lines of chains are used, it is advisable to have them between the carriage-way and the footpaths, which may safely rest upon the projecting ends of the transverse bearers. To avoid any unnecessary weakening of the piers or towers, it is usual to pierce them with arches for the carriage-way only; and in some bridges the inconvenience of making the foot-passengers turn into the carriage-way in passing under them is avoided by supporting footpaths outside the piers by iron consoles or brackets.

(Drewry's *Memoir on Suspension-Bridges*, 1832; Douglas's (Sir Howard) *Essay on the Principles and Construction of Military Bridges*, second edit., 1832; Ware's *Tracts on Vaults and Bridges*, published anonymously, 1822; *Edinb. Philosophical Journal*, vol. v., p. 238; *Penny Magazine*, Nos. 279 and 280; *Companion to the Almanac* for 1833, p. 222; *Memoirs of the Lit. and Phil. Soc. of Manchester*, second series, vol v., pp. 384 and 545; *Transactions of the Institution of Civil Engineers*, vol. iii., p. 219; &c.)

SUSQUEHANNA. [Pennsylvania.]

SU'SRUTA, one of the earliest and most celebrated of the Hindu writers on medicine, was the son of Viswamitra, and the pupil of Dhanwantari. Nothing is known of the events of his life, and his date is rather uncertain. His medical work is still extant, and has been lately published in two vols. 8vo., Calcutta, 1835. It is unquestionably of some antiquity, but it is not easy to form any conjecture as to its real date, except that it cannot have the prodigious age which Hindu fable assigns it; it is sufficient to know that it is perhaps the oldest work on the subject which the Hindus possess, excepting that of Charaka. The only direct testimony that we have with respect to the dates of Charaka and of Susruta is that of Professor Wilson, who states that, from their being mentioned in the Puranas, the ninth or tenth century is the most modern limit of our conjecture; while the style of the authors, as well as their having become the heroes of fable, indicate a long anterior date. One commentary on the text of Susruta, made by Ubhatta, a Cashmirian, is probably as old as the twelfth or thirteenth century, and his comment, it is believed, was preceded by others. The work is divided into six portions: the *Sutra St'hana*, or Chirurgical Definitions; the *Nidana St'hana*, or Section on Symptoms, or Diagnosis; *Sarira St'hana*, Anatomy; *Chikitsa St'hana*, the internal administration of Medicines; *Kalpa St'hana*, Antidotes; *Uttara St'hana*, or a supplementary section on various local diseases, or affections of the eye, ear, &c. In all these divisions however, surgery, and not general medicine, is the object of the book of Susruta; though, by an arrangement not uncommon with our own writers, he introduces occasionally the treatment of general diseases, and the management of women and children, when discussing those topics to which they bear relation. As this is the only Sanscrit medical work which (as far as the writer is aware) has been published, it will not be out of place here to give some account of the state of medicine among the Hindus, extracted from

two notices by Professor Wilson, published originally in the 'Oriental Magazine' (Calcutta, February and March, 1823), from which several passages are inserted by Professor Royle in his 'Essay on the Antiquity of Hindoo Medicine,' 8vo., London, 1837. The instrumental part of medical treatment was, according to the best authorities, of eight kinds—*Chhedana*, cutting or scission; *Bhedana*, division or excision; *Lek'hana*, which means *drawing lines*, appears to be applied to scarification and inoculation; *Vyadhana*, puncturing; *Eshyam*, probing or sounding; *Aharya*, extraction of solid bodies; *Visravana*, extraction of fluids, including venesection; and *Sevana*, or sewing. The mechanical means by which these operations were performed seem to have been sufficiently numerous: of these, the principal are the following—'*Yantras*, properly '*machines*, in the present case *instruments*; but to distinguish them from the next class, to which that title more particularly applies, we may call them *implements*; *Sastras*, weapons or instruments; *Kshara*, alkaline solutions or caustics; *Agni*, fire, the actual cautery; *Salaka*, pins or tents; *Sringa*, horns, the horns of animals open at the extremities, and, as well as *alabu*, or gourds, used as our cupping-glasses; the removal of the atmospheric pressure through the first being effected by suction, and in the second by rarifying the air by the application of a lamp. The next subsidiary means are *Jalauka*, or leeches.

'Besides these, we have thread, leaves, bandages, pledgets, heated metallic plates for erubescents, and a variety of astringent or emollient applications.'

The descriptions of the very numerous Hindu intruments not being very minute or precise, Professor Wilson says we can only conjecture what they may have been, from a consideration of the purport of their names, and the objects to which they were applied, in conjunction with the imperfect description given.

'The *sastras*, or cutting instruments, were of metal, and should be always bright, handsome, polished, and sharp, sufficiently so, indeed, to divide a hair longitudinally.

'The means by which the young practitioner is to obtain dexterity in the use of his instruments are of a mixed character; and whilst some are striking specimens of the lame contrivances to which the want of the only effective vehicle of instruction, human dissection, compelled the Hindus to have recourse, others surprise us by their supposed incompatibility with what we have been hitherto disposed to consider as insurmountable prejudices. Thus the different kinds of scission, longitudinal, transverse, inverted, and circular, are directed to be practised on flowers, bulbs, and gourds. Incision, on skins or bladders filled with paste and mire; scarification, on the fresh hides of animals from which the hair has not been removed; puncturing or lancing, on the hollow stalks of plants, or the vessels of dead animals; extraction, on the cavities of the same, or fruits with many large seeds, as the Jack and Bel; sutures, on skin and leather; and ligatures and bandages, on well-made models of the human limbs. The employment of leather, skin, and even of dead carcasses, thus enjoined, proves an exemption from notions of impurity we were little to expect, when adverting to their actual prevalence. Of course, their use implies the absence of any objections to the similar employment of human subjects; and although they are not specified, they may possibly be implicated in the general direction which the author of the 'Susruta' gives, that the teacher shall seek to perfect his pupil by the application of all expedients which he may think calculated to effect his proficiency.

'Of the supplementary articles of Hindu surgery, the first is *Kshara*, alkaline or alkalescent salts. This is obtained by burning different vegetable substances, and boiling the ashes with five or six times their measure of water. In some cases the concentrated solution is used after straining, and is administered internally, as well as applied externally.

'Care is enjoined in their use, and emollient applications are to be applied, if the caustic occasions very great pain. At the same time these and the other substitutes for instrumental agents are only to be had recourse to where it is necessary to humour the weakness of the patient. They are especially found serviceable where the surgeon has to deal with princes and persons of rank, old men, women and children, and individuals of a timid and effeminate character.

'The cautery is applied by hot seeds, combustible substances inflamed, boiling fluids of a gelatinous or mucous consistence, and heated metallic bars, plates, and probes. The application is useful in many cases, as to the temples and forehead, for headaches; to the eyelids, for diseases of the eyes; to the part affected, for indurations in the skin; to the sides, for spleen and liver; and to the abdomen, for mesenteric enlargements. As amongst the Greeks, however, the chief use of the cautery was in the case of hemorrhages, bleeding being stopped by searing the wounded vessels.

'If leeches, when applied, are slow and sluggish, a little blood may be drawn from the part by a lancet, to excite their vivacity; when they fall off, the bleeding may be maintained by the use of the horns and gourds, or the substitutes already mentioned for the cupping-glasses of our own practice.'

The operations are rude, and very imperfectly described. They were evidently bold, and must have been hazardous: their being attempted at all is however most extraordinary, unless their obliteration from the knowledge, not to say the practice, of later times be considered as a still more remarkable circumstance. It would be an inquiry of some interest, to trace the period and causes of the disappearance of surgery from amongst the Hindus—it is evidently of comparatively modern occurrence, as operative and instrumental practice forms so principal a part of those writings which are undeniably most antient; and which, being regarded as the composition of inspired writers, are held of the highest authority.

Besides these sacred writings, there are many valuable professional tracts which correspond with, and are, in fact, commentaries on them. These are said to have been composed by prophets and holy men (Maha Rishis), to whom is generally given a divine origin.

The different nations of India have their respective medical authors. In the peninsula and the south of India, in Tamul; those of the Telingas, in Teloogoo; in Bengal and the northern provinces, the works in use among the Hindus are in Sanscrit; while among the Mohammedan population Persian works and translations from the Arabic are chiefly in use.

The work of Susruta may now easily be procured, as it was one of those ordered to be printed by the Indian government for the use of its native subjects; but the printing of this, as well as of many others, was stopped, when most of them were nearly completed—the first volume and three-fourths of the second of the Susruta having been printed. Fortunately the Asiatic Society of Calcutta, with the spirit and zeal which has ever distinguished it, and with a true knowledge of what was for the benefit of the government itself, undertook, at their own risk, to complete the works.

SUSSEX is a maritime county in England, due south of Greenwich, the meridian of which passes very nearly through the centre of the county. It lies between 50° 43′ and 51° 9′ N. lat., and 0° 49′ east and 0° 58′ west long. It is bounded on the north-east by Kent, from which it is separated in part by the river Rother, in another part by the Teyse or Teise, a feeder of the Medway, and in another part by the Kent Water and other feeders of the Medway; on the west by Hampshire; on the north by Surrey; and on the south and south-east by the British Channel. The extreme length, from Lady-Holt park due east to the Kent Ditch, is 76 miles; its greatest breadth, from Beachy Head to Tunbridge Wells, 27 miles; and the average breadth a little less than 20 miles. The area is 1466 square miles, or 938,240 acres. The gross population in 1841 was 299,770, being an increase of 10 per cent. on the census of 1831, and giving 204 inhabitants to every square mile. In size it is the 14th of the English counties, in population the 18th, and in density of population the 28th. Lewes, the county town, is on the Ouse, 45½ miles from London, nearly in a direct line south, or 49 miles by the road through East Grinstead, Fletching, and Chailey, or 51 miles by the mail-road through East Grinstead and Uckfield.

Surface; Coast; Rivers.—The principal feature in the surface of Sussex is occasioned by the intervention of the high ridges of chalk hills generally known as the Downs. These hills rise from the marsh of Pevensey to the bold promontory of Beachy Head; they then trend westward as far as Shoreham, occupying a surface of about 26 miles in length, and six or seven in breadth, containing 99,840 acres. This tract is properly denominated the South Downs. From Shoreham the Downs gradually recede from the coast and traverse the western part of the county, bearing

some points towards the north, and enter Hampshire between West Harting and Stanstead near Petersfield. Their extreme length in Sussex is 53 miles, their greatest breadth 7, and mean breadth 4½ miles. The average height is about 500 feet above the level of the sea; but Ditchelling Beacon is 858 feet, Firle Beacon 820 feet, Chanctonbury Ring 814 feet, Rooks Hill and Bow Hill each 702 feet, and Beachy Head 564 feet above that level. The Downs have a rich covering of a short and delicate turf containing large portions of Thymum serpyllum, and occasional patches of the common furze, the Ulex Europæus, in patches of 30 or 40 acres. The whole district is without trees, except in some declivities where the white thorn is found, and in some of the richer portions at Stanmer and Arundel parks, where thriving plantations of beech and other hardy trees have been recently made. The surface of the Downs is gracefully undulating; the northern escarpment is precipitous, whilst the southern declines gently, and westward of Brighton gradually blends with the low land of the coast.

The maritime district lies between the Downs and the sea, and extends from Brighton westward to Emsworth, a distance of 36 miles. At first it is narrowed to a point, but gradually extends to the breadth of a mile between Brighton and Shoreham; towards Arundel it widens to three miles; and finally, as it approaches Hampshire, it becomes in many places seven miles wide. This district is of remarkable fertility. Here, in Saxon times, many salt-pans for procuring salt from sea-water by evaporation existed; their mention in 'Domesday' is frequent: one only, at Appledram, near Chichester, remains.

The centre of the county is occupied by a woodland tract, which extends from the Downs, to which it runs parallel, to the Surrey hills, denominated the Weald (Saxon *weald*, a forest). The Weald was once an immense forest, called by the Britons Coit Andred, and by the Saxons Andredes-weald, which was inhabited only by hogs and deer, but has been gradually cleared and brought into cultivation. According to the Saxon Chronicle, this wood was 'in length, east and west, 120 miles, or longer, and 30 miles broad.' This district within the county now contains about 425,000 acres, disposed in a line of country varying from five to ten miles in breadth, and from 30 to 40 in length.

The Forest Ridge is that portion of the county which, gradually uniting with the Weald, forms the north-eastern division. It stretches from Fairlight Down on the south by Crowborough to St. Leonard's Forest, and thence westward, terminating in an angle formed by the sand-hills of Petworth on one side, and by Blackdown and Leith hills in Surrey on the other. In this district are two great forests, St. Leonard's Forest, containing 10,000 acres, and Ashdowne Forest, containing about 18,000. Pine, fir, beach, and birch all grow well, and portions of the two forests have been planted with success. The whole ridge is the most romantic part of Sussex. It is broken into hill and dale, and is very elevated. Crowborough Beacon, the highest and most central eminence, is 804 feet above the level of the sea; Brightling Hill, 646 feet; and Fairlight Down, 599 feet.

The marsh-land extends across the eastern division of the county from Eastbourne into Kent, with the exception of five miles taken up by the Forest Ridge of Fairlight and the Hastings hills. Marshy tracts also exist on the borders of all the rivers.

The coast at the extreme east of the county is formed of the low marsh-land, which is a continuation of the low land of Romney Marsh. At Pett the Forest Ridge breaks in for five miles, taking in Fairlight, Hastings, and Bexhill. The low marsh-land of Pevensey, forming Pevensey Bay, extends from Bexhill to the Downs a short distance to the east of the well-known and bold promontory of Beachy Head. The high chalk cliffs of the Downs extend thence as far as Brighton, a distance of 19 or 20 miles coastways, when the low land of the maritime district intervenes and forms the coast line into Hampshire. Pevensey Bay and Seaford Bay form good roadsteads for vessels with north or north-east winds, and the latter is much frequented by vessels for water. A lighthouse of the first class was erected in 1828 on the summit of the second cliff to the westward of Beachy Head, 285 feet above the level of the sea, as a beacon for ships, which were often driven on shore in storms from the south-west, and caverns have been cut in the cliffs between the head and Cuckmere Haven to afford places of refuge to such mariners as may be wrecked on this dangerous coast. The lowest part of the coast from Seaford to the Kentish boundary is protected by single round towers, called Martello towers. They commence near Hythe in Kent, and are continued, except where the coast is of easy defence, in consequence of the cliffs or the military canal, to Seaford, where the last tower is numbered 74. They are built on the beach at intervals of about a quarter of a mile between each. They are about 32 feet in height, and were surmounted by swivel guns. The period of their erection was at the time of the threatened invasion of England by Napoleon. At the same time a portion of this low district, from Cliffe End, near Pett, in Sussex, to Shorne Cliffe, in Kent, a distance of 23 miles, was protected by a canal called the Royal Military Canal. It runs parallel to the sea. The breadth is about 60 feet, and the depth 9 feet: it has a raised bank, or redan, on the northern side, to shelter the soldiery and enable them to oppose the enemy with greater advantage. Its line is very little above the level of the sea.

The principal rivers are the Ouse, the Rother, the Adur, the Arun, the Cuckmere, and the Lavant.

The Ouse begins at Rylands, a few miles north of the village of Lindfield, at the junction of two streams, one of which issues from Bantrudge farm in the forest of St. Leonard, and the other from Selsfield on the borders of the forest at Worth. After the confluence of the two streams, the river flows near Lindfield, and, pursuing a tortuous course to the south-east, half encircles Sheffield Park; then proceeding more directly south, the stream runs by Isfield, Barcombe, and Hamsey to the Lewes levels, which it enters to the north of the town. After separating the Cliffe from the town of Lewes, it proceeds through the levels, divides the South Downs, and having received several small tributary streams, discharges itself into the British Channel at the new mouth of Newhaven, forming what is called Newhaven Harbour: the former outlet at Seaford is closed. [SEAFORD.] The river is navigable for large barges for 12 miles from its mouth without the aid of locks, and with them as far as Lindfield. The waters are used for paper-mills at Lewes and Isfield, and for a large corn-mill at Barcombe.

The river Rother rises near Argus Hill, in the parish of Rotherfield, close under the Forest Ridge. Thence it runs to Mayfield, receiving at Bevilham a large brook that runs from Wadhurst: it then flows in a south-easterly direction towards Kent, passing Etchingham, and receiving a stream that comes from Burwash, it next proceeds to Bodiam. It first touches Kent at Wigsell, in the parish of Salehurst, at the junction of a small stream which rises at Flimwell, near Hawkhurst, and separates the two counties. After the junction with this stream, the Rother forms for some distance the border, and proceeding to Newenden and Wittersham, receives in its course several small streams from the Weald of Kent, the arms of which, together with the Rother itself, enclose the river Island of Oxney. After passing this island, it quits the border, and turns suddenly southward across the eastern extremity of the county, sending off a branch at Iden called the Kent Ditch, which parts the two counties, and empties itself into the sea in the parish of Broomhill, a mile and a half eastward of old Rye Harbour. Proceeding from this branch, the Rother flows to the south-east part of the town of Rye. At this spot the Rother receives the waters of the Tillingham, which rises in the parish of Beckley, on the borders of Ewhurst, itself augmented at a short distance above Rye by the Tweed, a small stream that flows from Playden. Below the town of Rye the Rother receives also the waters of the Brede, which rises in Ashburnham Wood, near Battle, and flows through Whatlington, to Sedlescombe and Brede, and thence to the foot of the hill on which New Winchelsea is built. The united stream then expands into an æstuary, forms the harbour of Rye, and empties itself into the sea at the bight of the bay formed by Fairlight Head on the west and Dungeness on the east. [RYE.]

The Rother is navigable as far as the point where it first touches the borders of Kent above Newenden. This river, which was anciently called Limene, formerly flowed by Newenden to Maytham, and then by Smallhythe and Reading to the town of Appledore, whence it continued eastward, and emptied itself into the sea at New Romney in Kent, on the eastern side of Dungeness, and twelve miles eastward of its present exit; but in the great storm of the 1st of October, 1250 (34 Henry III.), which overwhelmed Old Winchelsea, and during the great inundation of the sea, this river forsook its ancient channel and formed the

nes one to Rye. In the year 893 the Danish fleet of 330 sail under the command of the pirate Hastinges, assembled near Boulogne, and directed its course to the English shores. Two hundred and fifty vessels entered the river Rother or Limene, which is described in the Saxon Chronicle as 'at the east end of the vast wood which we call Andred. The river floweth out of the Weald. On this river they towed up their ships as far as the Weald, four miles from the mouth outwards, and thereon destroyed a fort whereon sat a few churls, and which was hastily wrought.' It is remarkable that in the year 1822, one of these Danish ships was discovered embedded in ten feet of mud and sand in a field at Northiam, a short distance from the present navigable river, at the west corner of the Isle of Oxney, about two miles from Newenden. The ship was in a perfectly sound and entire state after a lapse of 929 years. Her dimensions were from head to stern sixty-five feet, and her width fourteen feet, with cabin and forecastle; and she appeared to have originally had a whole deck. She was very strongly built, her bill pieces and keel measuring two feet over; her cross-beams, of which there were five, 18 inches by 8, with other timbers in proportion. In her caulking was a species of moss peculiar to the country in which she was built. In the cabin and other parts of the vessel were found a human skull, a pair of goat's horns attached to a part of the cranium, a dirk or poniard, several glazed and ornamental square tiles, some bricks which had formed the fire-hearth, several parts of shoes or sandals, fitting low on the foot, one of which was apparently in an unfinished state, having a last remaining in it, all of them very broad at the toes, two earthen jugs and a stone mug of ancient shape, a piece of board with thirty perforations, probably designed for keeping the lunar months, or some game, with many other antique reliques. The discovery of this vessel affords a singular confirmation of the accuracy of King Alfred's account of the Danish invasions, as described in the Saxon Chronicle.

The Adur has three sources: one branch rises at Toats Farm near Slinfold, whence it flows past Shipley and Knepp Castle to West Grinstead; another rises at Nuthurst, and, running to the west of West Grinstead Park, joins the first stream at Bay Bridge, whence they both flow to a place near Ashurst, where they are augmented by the third stream, which rises at Slaugham close by St. Leonard's Forest, and, pursuing a tortuous course, runs through Twineham and Shermanbury. From Ashurst the river flows in a due southern direction, between Beeding and Bramber, running on the east side of the castle and near the walls, and thence past Botolphs and Coombes to Shoreham Harbour and the sea. [SHOREHAM.] The river is navigable for small craft from Moak Bridge in the parish of Shermanbury, to the mouth; and it is celebrated for its mullet, pike, and eels.

The Arun also rises in St. Leonard's Forest, within the rape of Bramber, and passes into the parish of Slinfold: it then flows due south, and receives at Stopham the waters of a small river called the Western Rother, which rises in Lurgashall parish, and proceeds in a southerly direction to Selham. At Selham the Western Rother is augmented by the waters of another small stream called the Western Arun, described by Harrison as 'a goodlie water, and thereto increased with no small number of excellent and pleasant brookes: it springeth up of two heads, whereof one riseth by west, by the rills which lie towards the rising of the sunne from East Meon, and runneth by Petersfield; another comes from Bunton Wood and joineth with the foregoing at Petersfield and Durford; after which confluence they go together and in one channel still towards the east, taking a rill with them that commeth between Fernhurst and St. Luke's chapel, south-west of Linchmere, and meeting with it east of Lodsworth.' After the junction at Selham the Western Rother takes an easterly direction, passing near Burton Park to Stopham. From Stopham the Arun thus augmented runs in a circuitous course, passes Hardham and Amberley, in which part the stream is celebrated for trout, through the marshes forming the rich vale of Arundel, and flowing through Arundel town enters the sea at Littlehampton. The channel is led in a southerly direction into the sea between two piers composed of piles with an extension of dicker-work. The depth of water at the entrance between the piers is from two to three feet below the ordinary level of low-water in the sea, but a bar extends outside the dicker-work, across the mouth, which rises about two feet above the general surface and is left dry at low-water. The lift of average spring-tides is about sixteen feet, and of neaps eleven feet. The tide flows nearly seventeen miles up the river, but the backwater is of little value, in consequence of the narrowness of the channel and the sluggishness of the stream. The larger vessels which enter usually remain near the river's mouth at Littlehampton, but a vessel of thirteen feet draught can proceed to Arundel bridge, a distance of six miles, the bottom continuing of a uniform level throughout that extent. The lower part of the river is famous for its mullet.

A canal called the Arun and Wye Junction Canal, formed under an Act of 53 Geo. III., connecting the Arun with the river Wye, completes an inland communication by water with London. The Arundel and Portsmouth Canal also enters the Arun at Ford, connecting it with Chichester Harbour; and by an Act obtained by the Earl of Egremont in 1791, a canal following the course of the Rother has made a navigable water-communication from Stopham bridge to the town of Midhurst, with a branch to Haslingbourne, within half a mile of Petworth.

The Cuckmere rises in the Forest Ridge near Heathfield Park, and runs thence in a south-south-west direction through Warbleton to Hellingly, giving motive-power to several water-mills. It then winds round Hempstead farm and the Old Priory of Michelham, to Arlington, whence it proceeds southerly through the valley past Berwick Court and the small town of Alfriston to Exceat, and finally empties itself into the sea at the opening in the South Downs, to the westward of Beachy Head, between the Seaford and Friston hills, about two miles south-east from Seaford. A shingle beach crosses the entrance, and rises several feet above low-water; the interior of the haven is left dry at three-quarters ebb; the channel is very narrow and crooked, but at high-water it is navigable for small barges to Longbridge, about a mile above Alfriston

The Lavant has its source in Charlton Forest, and runs in a south-west direction through Singleton, Binderton, and the villages to which it gives its name, and after circling the city of Chichester on all sides except the north, falls into the harbour of Chichester, and enters the sea at the extreme south-west corner of the county. The æstuary at the mouth of the river is famous for its lobsters; and the rocks next Selsey Bill are celebrated for cockles.

There are also two smaller rivers which discharge themselves into the sea, the Ashbourne at Pevensey, and the Asten near the spot where William the Conqueror landed. The latter river runs through the battle-field of Hastings.

The Medway also rises in the northern part of the county. Its source is at Turner's Hill, in the parish of Worth, whence it flows in an easterly direction through Forest-row in the parish of East Grinstead, and through Hartfield and Withyham. It reaches the county of Kent between Groombridge and Ashurst, forming the boundary between the two counties for about a mile, and then turns at Ashurst directly into Kent, at a spot about four miles from Tunbridge.

The London and Brighton Railroad, which was opened on the 21st September, 1841, connects the metropolis with the nearest point of the sea-coast. It branches off from the Croydon Railway to the north of that town, and then proceeds in a direction nearly due south, and at a short distance to the east of the old mail-road: it passes through Merstham, where there is a deep cutting and long tunnel to Horley, and enters the county of Sussex in the parish of Crawley, twenty-eight miles from London: from Crawley it goes to Balcombe, where the high Forest Ridge is passed by another tunnel: it crosses the valley of the Ouse by a beautiful viaduct: it enters the chalk ridge through a deep cutting and tunnel at Clayton, whence it is carried through cuttings in the chalk to the north-east of Brighton. The whole distance from London is fifty miles and a half, but seven miles of the Croydon line is used, so that the whole distance of the new line is forty-three miles and a half; the cost of which, including engines and carriages, has been 2,840,000*l.* It has five tunnels, together three miles and a quarter long, the Merstham and the Clayton being each more than a mile in length. The principal shaft of the Clayton tunnel is 270 feet deep; the Merstham cutting is 180 feet deep, and there are many cuttings not less than 80 feet to 125 feet. The undertaking was projected in 1834, by Sir John Rennie, and has been executed under the direction of Mr. Rastrick.

The mail-roads which enter the county of Sussex are four. The road from London to Hastings enters the county

at Frant, near Tunbridge, and runs in a southern direction through Robertsbridge and Battle; the road from London to Brighton enters the county in the parish of Ifield, and runs thence through Cuckfield; the road from London to Portsmouth traverses a small portion of the western division of the county near Petersfield; and the road from Dover to Portsmouth, which runs parallel with the sea-shore, enters Sussex near Rye, and proceeds to Winchelsea, Hastings, Battle, Lewes, Brighton, Worthing, Arundel, and Chichester, quitting the county for Hampshire near Havant. There are also many other roads of less importance. A road branches from the Brighton mail-road, and leads through East Grinstead, Maresfield, and Uckfield, to Lewes, Newhaven, and Seaford. Another road leads from Tonbridge, through Hartfield, and joins the Lewes road at Maresfield. The road from London to Worthing enters the county near Horsham, and passes near Steyning and Bramber. There is a road close to the sea-shore from Hastings, through Pevensey and Eastbourne, to Seaford, Newhaven, and Brighton, with a branch from Eastbourne at the foot of the Downs to Lewes.

Climate.—The climate of the southern part of the county, near the sea-coast, is mild, and not subject to many variations of temperature. The mean temperature of the year is 51·10°, more than one degree above the mean temperature of London. The consequence is, that large towns have sprung up to which invalids and others repair for health and relaxation. The climate at Worthing is so mild, that figs are cultivated in great perfection in the neighbourhood, and Hastings possesses many advantages for invalids. The mean temperature of the three winter months at Hastings is 43°, whilst the mean temperature of winter in the adjoining southern counties is generally only 40·35°. The soil of Hastings is a dry sand-rock, which is warm, and as the town is sheltered on the north and east by high hills and the aspect is south, it is favourable for the winter residence of all persons affected with diseases of the lungs; the disadvantage is, that the climate is too relaxing for those who require a dry air without its being keen. At Brighton the air at the east part of the town is generally dry and bracing, but in the valley near the centre of the town and to the west the air is more mild. The downs fronting the south-west are bleak, being exposed to the violent winds from that quarter, which prevail for two fifths of the year, during which the atmosphere is frequently charged with saline exhalations from the sea. The higher or northern part of the county, particularly the Forest Ridge, is of considerably lower temperature. In the Weald the circulation of air is impeded by the forests and high hedges, and the climate is cold and damp.

Geology.—The greater portion of the southern part of the county is occupied by the chalk formation, which constitutes its most striking geological feature. The general dip or inclination of this, as indeed of all the strata in the county, is to the south-east, with occasional exceptions. The face of the chalk is marked with fissures or wells, and scooped into deep hollows, furrows, and basins, which are more or less filled with tertiary sand and gravel. In many places quarries have been opened and kilns erected for converting the chalk into lime for the use of the agriculturists, who annually consume large quantities. The Sussex chalk varies in colour from pure white to a bluish-grey; the harder varieties were in great request among the Normans for building. The walls of several old castles and religious houses were built with chalk faced with Caen stone or flints. The chalk is regularly stratified. The upper division contains horizontal layers of siliceous nodules with intersecting veins of tabular flint: sulphuret of iron is found in irregular masses and in octahedral crystals. Chalk-marl constitutes the foundation of the chalk hills: its outcrop connects the detached parts of the range and composes a fertile tract of arable land, on which are some of the best farms in the county. Below the marl is a bed of fire-stone, which is obscurely traced in the eastern part of the county, but to the west forms a terrace of considerable breadth. The galt, the lowest division of the chalk formation, generally contitutes a valley within the central edge of the chalk, and may be traced, with little interruption, from Eastbourne westward along the whole county into Hampshire, forming a stiff soil, but very rich.

Next to the chalk the most important formation is the Wealden. It joins the galt and extends through the centre of the county. It is a series of clays and sands with subordinate beds of limestone-grit and shale: it forms an anticlinal axis of considerable elevation, the direction of which is nearly from east to west. This district is an irregular triangle, the base extending from near Pevensey to Seabrook in Kent, and the apex being situated near Harting Comb in the western part of Sussex. The wealden-clay is a tenacious clay of various shades of blue and brown, containing subordinate beds of limestone and sand with layers of septaria of argillaceous iron-stone. It forms the subsoil of all the Wealden district, and separates the Shanklin sand from the central mass of the Hastings beds. It constitutes a low tract from five to seven miles in breadth, and presents no remarkable features on the surface, except that the soil is extremely favourable to the growth of oak, for which the county has been long famous. The Sussex marble occurs in layers in different parts of the district. It is a limestone of bluish-grey mottled with green and ochraceous yellow, and is composed of the remains of fresh-water univalves formed by a calcareous cement into a beautiful compact marble which bears a high polish. It was used by the Romans, and in the early Norman times it was sought after and employed as Purbeck marble is now. It is much used in Canterbury and Chichester cathedrals; in the former the archiepiscopal chair is formed of it. The central group of the Wealden is formed of alternating sands, sandstone, and shale, which have been denominated the Hastings beds. [HASTINGS SANDS.] These beds extend on the east and north-east of the county, from Bexhill to Ham Street near Aldington in Kent, forming a line of irregular cliffs 30 or 40 miles in length, from 4 to 9 miles in width, and from 20 to upwards of 600 feet in height. On their first emergence from beneath the Weald clay these beds consist of sand and friable sandstone, with occasional interspersions of ironstone and a great intermixture of small portions of lignite. Below this are the Tilgate beds, the lowest stratum of which contains large concretional or lenticular masses of a compact calciferous grit or sandstone in three or four layers, each varying in thickness from two to three inches, which was formerly extensively quarried and used for paving and roofing. These beds extend from the western extremity of the Hastings sands at Loxwood to Hastings, and are separated from the next subdivision by blue clay and shale. This subdivision, called the Worth sands, consists of a series of arenaceous strata, some of which form a fine soft building-stone extensively used. The last division of the Wealden is composed of the Ashburnham beds, which occur beneath the Worth stone: they are composed of alternations of sand, friable sandstone, shale, and clay: they are for the most part highly ferruginous, and enclose rich argillaceous iron-ore and large masses of lignite. It was in the Wealden strata, when wood was abundant and charcoal employed in smelting iron, that the chief iron-works of Sussex were situated, the iron-ore being extracted from the iron-stone of the argillaceous beds. Up to the year 1720 Sussex was the principal seat of the iron-manufactory in England; the consumption of fuel was so great, that more than one act was passed for the preservation of the timber, but the wood still decreased, and by degrees the furnaces were disused and the manufacture transferred to districts where coal was abundant. The last furnace, at Ashburnham, was blown out in 1827.

The plastic clay is the foundation of the flat maritime district south of the downs, which extends from near Worthing to Bracklesham Bay, and thence into Hampshire, forming part of the Isle of Wight basin; and is also seen in insulated patches on Castle Hill, Newhaven, and in many other localities.

The London clay, which in some localities includes beds of grey limestone and sandstone, is also found; the clay constitutes the flat maritime district of the south-west part of the county, and the limestone composes groups of rocks on the coast.

The valleys of all the rivers, and the large levels of Lewes, Pevensey, and Brede, the soil of which is extremely fertile, furnish rich marsh pastures almost equal to Romney Marsh, and are formed of alluvial deposits. These levels are from 3 to 7 miles in breadth, and extend 8 or 10 miles in length.

Agriculture.—The rich marsh-lands, of which there are about 30,000 acres in the county, make an excellent pasture-ground, on which many oxen and sheep are reared and fatted for market. There are also about 50,000 acres of down-land, where the soil is thin and very near the chalk, which are unfit for the plough. They are therefore left in down, and produce excellent pasture for the small sheep known as South Down sheep. The natural grasses, when kept

cropped by sheep, are sweet; but if the downs are not sufficiently stocked, they are soon overgrown with furze and heather, and the coarse grasses become prevalent. In the lower or marsh-land the proportion is generally one ox to the acre, and sheep are mingled with the oxen. In the Pevensey Level, where there is plenty of water and grass is abundant, there are most cattle; but even here sheep are increasing. In the Brede Level there are more sheep, and only one bullock to every four acres, in order to keep the pasture even. After the hay is cut and carried, the pastures are usually occupied by cattle and sheep. Stall-feeding is also much and successfully practised in Sussex.

Throughout the whole of the Wealden district, upon the sand as well as the clay soils, the land is extremely poor; and of the 903,000 acres cultivated within the county, 425,000 are situated within this district. The clay is cold and stiff, and very difficult of drainage; but it produces fair average crops of wheat. The usual rotation of crops is, wheat, oats, clover or trefoil one or two years, and then a fallow: sometimes peas or tares are substituted for clover. On these lands lime forms a great proportion of the manure; but, from constant use, it has lost much of its beneficial effect. In this district large commons have been recently enclosed and brought into cultivation at considerable expense; and some parts on the edge of the forests have been planted with fir and birch, which have thriven wherever the land was properly trenched and drained. When the Rev. A. Young wrote, he estimated the waste lands at 110,000 acres: the quantity has been since diminished at least one-third.

The arable land on the Downs consists of thin light layers of earth, not exceeding 8 inches in depth, intermixed with flint pebbles, and is very favourable for the growth of barley: wheat is usually sown once in four years, the course being turnips, barley, clover, and wheat, changing the clover for peas or some other crop the eighth year. In some of the hollows the soil is deeper and more loamy, and so dry as to allow of its being ploughed quite flat without any ridges or water-furrows: this is the richest Down-land, and the rotation is wheat, barley, and clover, varying the clover, and substituting turnips, rape, tares, or peas, the sixth year, as the same land will not bear clover frequently. Along the slopes of some of the hills the soil is of a tough tenacious nature, being a mixture of chalk washed down from the hills by the rains and stiff clay, and is very difficult to cultivate. In the spring it is extremely heavy, and retains moisture for a long time; but when dried it becomes so hard, that unless worked at the exact moment, when it is dry on the surface and the clods are still moist, there are no means of reducing it to a proper tilth: when carefully managed and properly manured, it produces good crops of wheat, oats, and beans. The rich arable land in the county is about 120,000 acres.

Like their neighbours in Kent, the Sussex farmers are not ready to adopt improvements in agricultural machinery: they do not like changes in the system of their forefathers, and they adhere with pertinacity to the old turn-wrest plough, drawn with four horses on the lightest soils, and, on all the stiffest, by six, or frequently by eight or ten oxen. [Kent.] Almost every Sussex farmer works oxen as well as horses. They think there is an advantage in the tread of the ox on very light soils; and that on very heavy lands in the summer, where great strength is required to break up the soil a good depth, the steady draft of the ox is superior to the quick working of the horse. Steers or young oxen are generally broken in for the yoke at three years old, and are worked till six or seven, when they are turned off to fatten. The drill has been received with some favour, and is in common use near the Downs. Threshing-machines were becoming general till 1831, when many were destroyed by the labourers during the agricultural riots, and have not been again erected. The Sussex farmers are very much behind other counties in the management of their farms. A large portion of their land is unfavourable for the introduction of the Scottish convertible system; yet much might be learned by a careful examination of the system of culture pursued in the south of Scotland.

Hops are cultivated to a considerable extent in the eastern part of the county: they have been introduced from Kent, and have gradually extended themselves westward. Upwards of 8000 acres are now under cultivation. The produce however is not so much esteemed in the market as that of Kent.

There are still many extensive woods in Sussex, amounting altogether to about 150,000 acres. The produce of bark is not so great as it has been, but the demand for hop-poles causes great attention to be paid to the cultivation of underwood and coppices, which yield a greater annual return from the land than if they were grubbed up.

The county is noted for its breed of oxen and of sheep. The Sussex ox bears a strong resemblance to the Devon: it has a small and well-formed head, the horns pushing forward a little, and then turning upward, thin, tapering, and long, not so as to confound the breeds with the long-horns, and yet in some cases a little approaching to them. The eye of the ox is full, large, and mild, but with some unquietness in the cow: the throat is clean, and the neck long and thin, although the neck and head are both coarser than the Devon. At the shoulder is the main point of difference and principal defect in the Sussex cattle; the whole fore-quarter is thickly covered with flesh, giving too much weight to the coarser and less profitable parts. The fore-legs are more perpendicular than in the Devon, and placed more under the body. The barrel is round and deep; the back straight; the belly and flank are capacious, yet the beast is well ribbed home: the loins are wide, the hip-bone does not rise high, nor is it ragged externally. The tail, which is fine and thin, is set on lower than in the Devon; yet the rump is nearly as straight, and the hind quarters are cleanly made. The colour is a deep chestnut-red, and some of a blood-bay: much deviation from these colours indicates a stain in the breed. This ox holds an intermediate place between the Devon and the Hereford, with all the activity of the first and the strength of the second; with the propensity to fatten, and the beautiful fine-grained flesh of both. Experience shows that it possesses as much of the good qualities of both as can be combined in one frame. The hide is soft and mellow, a coarse hard thick hide being considered a test of an ill-bred or unprofitable beast. The coat is short and sleek. The average weight is about 120 stones, but some have reached 216 stones. The breed of oxen was becoming neglected in the county, when, some three or four years since, Mr. Selmes, of Beckley, thinking that they were entitled to more consideration than they obtained, challenged Earl Spencer to show one hundred head of cattle of any breed, bred by himself, against 100 head of Sussex cattle bred by Mr. Selmes. The challenge was accepted: the prize was awarded to Earl Spencer; but so good was the Sussex stock shown, that the breed has once more come into repute. The Sussex cow is a very inferior animal to the ox: she yields a very small quantity of milk, and is therefore principally kept as a breeder, all the use being made of her for the dairy which circumstances will allow. The cows have also one great fault: their very countenance indicates an unquiet temper, and they are often restless and dissatisfied, prowling about the hedgerows and endeavouring to break pasture. Nearly all the calves are reared, the males for work, and the females for breeding or early fattening. A good cow, after her own calf has been weaned, will suckle another, and sometimes even two others for the butcher; and it is not uncommon for the farmers to procure calves from Smithfield for this purpose.

The Southdown sheep are among the best for all hill countries where the grass is short; and their kindly properties have caused them to penetrate into almost all parts of the country. They have a patience of occasional short keep, and an endurance of hard stocking equal to any other sheep, and an early maturity scarcely inferior to the Leicester, while the flesh is very fine grained and of peculiarly good flavour. It is only within the last 70 years that these sheep have shown so much goodness. They were bad in shape and unkindly feeders when they were first bred by the late Mr. Ellman of Glynde, whose care and attention, without crossing, raised them to their present worth. The South Down sheep are polled, and are black or grey on the head and legs. The characteristics of a well-bred sheep are, that the head is small, the lips thin, and the space between the nose and the eyes narrow; the under-jaw and chap also fine and thin; the ears tolerably wide, and, like the forehead, well covered with wool; the eye is full and bright; the breast wide, deep, and projecting forwards; the belly and back both straight; the carcass round and full; the hind-legs somewhat separated, giving a fulness to the haunches; and the bones fine, yet having no appearance of weakness. The average dead weight is from 8 to 11 stone, yet some have been killed which have reached to 21 stone. The wool is short, close curled, and fine and free from spiry pro-

jecting fibres; the average weight of the fleece is from 2½ to 3 lbs. The number of these sheep on the downs has been estimated at 270,000 in summer and 220,000 in winter, or about one and a half on an average all the year per acre; but we are inclined to think the estimate too low. On the richer and wet land in West Sussex a heavier sort of sheep, a cross between the Somerset and the Down, is much more used than the pure Down.

The breed of horses is not famous. Great efforts at improvement were made by the late earl of Egremont, in whose stock was the famous Whalebone blood, and who offered an annual prize at Egdean fair for colts bred from his stock. Of late years a horse-fair, at which prizes have been awarded, has been held at Lewes. These efforts have not been attended with much success. The breed is certainly improved, though still far from good.

The largest fairs in Sussex are Horsham, for sheep and lambs on 5th April and 18th July, for horses and cattle on Monday before Whitsuntide and on 27th November, and for Welsh cattle on 17th November; Easthoathly, on 8th April; East Grinstead (cattle), on 21st April and 13th July; Cross-in-Hand (cattle), on 23rd April and 19th November; Crowborough (cattle), on 25th April; Lewes, on 6th May and Whit-Tuesday for cattle, on 20th July for wool, and on 21st September and 2nd October for sheep; Burwash (cattle), on 12th May; Arundel (cattle), on 14th May and on 21st August; Winchelsea (cattle), on 14th May; Battle (cattle), on Whit-Monday and 6th September; Mayfield (cattle), on 30th May and 13th November; Steyning (cattle), on 9th June, 19th September, and 11th October; Hailsham (cattle), on 3rd June; the Dicker (sheep), on 23rd July; Petworth, on Holy Thursday for cattle, and on 20th November for sheep: Chichester on 4th May, 6th August, 11th October, and (sheep) 20th October; Lindfield (sheep), on 5th August; Egdean (horse and cattle), on 4th September; Findon (sheep), on 14th September; Robertsbridge (hops, cattle, and horses), on 25th September; and St. John's Common (sheep), on 4th October.

Divisions, Towns, &c.—Sussex has been for centuries divided into six Rapes, a term peculiar to the county, the derivation of which is not satisfactorily settled. Somner derives it from *rap*, Saxon, a rope; and Junius from *repp* or *rypp*, Islandic, a tract or district. Each rape contains several hundreds and other smaller divisions. The county has also been for many years subdivided for all civil purposes into two divisions, the eastern and the western, the former comprising the rapes of Lewes, Pevensey, and Hastings; and the latter the rapes of Chichester, Arundel, and Bramber; and by the act of 19 Hen. VII., c. 24, particularly referring to this county, it is enacted 'that the county courts shall be holden and kept one time at Chichester and the next time at Lewes, and so to be kept *alternis vicibus* for ever.' After the Norman conquest these rapes were granted to powerful followers of William, each of whom either occupied the old castle within the rape, or built a new feudal abode. Chichester rape alone had no castle for the residence of the lord, though a fortification was erected immediately after the Conquest for the defence of the inhabitants. Chichester rape formed part of the Honor of Arundel, and was granted to the same nobleman, who possessed the castle and rape of Arundel. The rapes are as follows:—

Eastern Division.—I. Lewes rape occupies the centre of the county, and extends from the borders of Surrey on the north, where it is 6 miles broad, to the sea on the south, where it is 13 miles in width. Its eastern boundary is formed by the Ouse, by which it is separated from the rape of Pevensey, and its western by the Adur, which divides it from the rape of Bramber. This rape was granted by the Conqueror to William, Earl de Warren, who married Gundred, daughter of the king, and founded the castle of Lewes and priory of St. Pancras there. With the descendants of Earl de Warren the barony remained till the beginning of the 14th century, and then, in default of male issue, it passed into the family of Fitzalan, earl of Arundel, where it continued till 1439, when, by the death of Thomas Fitzalan, 15th earl of Arundel, without issue, it was divided among his three sisters. It is now vested in the following proportion:—In the Abergavennys one-half, as heirs of the Beauchamps and the Lenthalls; in the Norfolks one-fourth, as heirs of the Mowbrays and Lenthalls; and in the Dorsets one-fourth, which was conveyed to Sir Richard Sackville, 21st April, 1566, but whether as a gift or by purchase is uncertain. The rape comprehends an area of 129,580 acres, and had in 1831 a population of 71,921. When 'Domesday' was compiled it included 10 hundreds and the borough of Lewes. It is now divided into 12 hundreds and the borough, containing 50 parishes. The following are the hundreds:—

1, Barcombe; 2, Buttinghill; 3, Dean; 4, Fishersgate; 5, Holmstrow; 6, Lewes borough; 7, Poynings; 8, Preston; 9, Southover borough; 10, Street; 11, Swanborough; 12, Whalesbone; and, 13, Younsmere.

II. Pevensey rape adjoins the rape of Lewes, which forms its western boundary. It extends from the borders of Surrey and Kent on the north to the sea, the greatest width of the county being in this rape, from Frant to Beachy Head, a distance of 27 miles. The width of the rape along the coast is nearly 18 miles, but in other parts the width varies from 20 miles to 8 or 10. It is bounded on the east by the rape of Hastings. Immediately after the Norman conquest the barony of Pevensey, together with the castle, was granted to the earl of Moreton, brother-in-law of the Conqueror, but it was forfeited by his son, after the battle of Tenerchebrai, to king Henry I., who granted it to Gilbert de Acquila, the descendant of a distinguished Norman family, whose grandfather had perished at the battle of Hastings. From this family the barony took the name of the Honor of the Eagle. Richard, son of Gilbert, having joined the rebellion of Robert de Belesme, the honor and barony were once more forfeited, and granted to Henry Fitz-Empress, afterwards Henry II. That king, after his accession to the throne, reinstated Richard de Acquila, and the Honor of the Eagle remained in that family till the time of his grandson, who passed over to Normandy without the king's licence, and the barony was seized by Henry III., by whom it was granted to Gilbert Marshall, earl of Pembroke. The earl however fell into disfavour, and surrendered the barony to the crown. It was then granted (1241) to Peter de Savoy, uncle of queen Eleanor, for his better support; and soon after his death, in 53rd Hen. III., the whole honor was given to Prince Edward and his heirs. It remained in the crown till 44th Edward III., when John of Gaunt, duke of Lancaster, obtained a grant of it in tail general. On the accession of Henry IV., the king, by letters-patent dated 12th February, 1400, granted the office of constable of the castle (an office created by John of Gaunt), together with the honor, to Sir John Pelham and his heirs, in consideration of his valuable services. The office of constable was held by the Pelhams till 4th Henry V., but other constables were afterwards appointed; and in 1600 the honor was once more in the crown, forming part of the duchy of Lancaster. Subsequently it was granted by king William, in 1706, to William Bentinck, duke of Portland, who sold it in 1730 to Spencer Compton, earl of Wilmington; and his granddaughter marrying Lord George Henry Cavendish, afterwards earl of Burlington, carried the castle and honor to that noble family, in whom they still remain. The rape, which is the largest in the county, has an area of 228,930 acres, and had in 1831 a population of 49,776. In the Conqueror's time it was divided into 16 hundreds; but it has now 19 hundreds subdivided into 52 parishes. The following are the hundreds:—

14, Alciston; 15, Bishopstone; 16, Danehill-Horsted; 17, Dill; 18, Eastbourne; 19, East Grinstead, borough; 20, Flexborough; 21, Hartfield; 22, Lindfield Burleigh Arches; 23, Longbridge; 24, Loxfield Camden; 25, Loxfield Dorset; 26, Lowey of Pevensey; 27, Ringmer; 28, Rotherfield; 29, Rushmonden; 30, Shiplake; 31, Totnore; and, 32, Willingdon.

III. Hastings rape forms the eastern portion of the county: it is in the shape of a triangle, the apex of which is part of Broomhill parish, the western side or base being formed by the rape of Pevensey, the south-eastern side by the Channel, and the north-eastern side by the county of Kent. The width at the base is 23 miles, and the extreme length, from the base to the apex, 28 miles. It has a coast-line of 23 miles. The Honor of Hastings was at the Conquest granted by the crown to Robert, second earl of Eu, of a powerful Norman family, who had been the first with whom William consulted after he had conceived the project of the English expedition, and who had distinguished himself alike by the zeal with which he entered into the plan, and by his personal bravery at the battle of Hastings: the castle is supposed to have been built by him. The honor and castle were seized by a stratagem on the death of William, but were soon regranted to

William earl of Eu, son of Robert. In this family it remained till the extinction of the male line on the death of Henry, the sixth earl, in 1194. The barony then passed to his mother Alice, countess of Eu, daughter of William D'Albini, earl of Arundel, whose son by the second marriage with William de Ysenden succeeded her, but in 29th Henry III. the estate was forfeited for his adherence to the king of France. It was subsequently held for a few years by Prince Edward, but in 16th Hen. III. it was granted to Peter of Savoy, from whom, in 53rd Hen. III. it passed by exchange to John, duke of Brittany, and continued in that house till it became extinct in the person of Joan, widow of Ralph, lord Basset. It subsequently passed in the same manner as Pevensey to John of Gaunt and the Pelhams, but in 23 Hen. VI. the lordship of the barony and castle was separated from the rape, and was granted to Sir Thomas Hoo, afterwards created lord Hastings. The rape and castle remained separated till the time of James II., when the barony and castle were repurchased by Sir Thomas Pelham from Henry, third earl of Huntingdon; and in the Pelhams the united honor has continued to the present time. The rape has an area of 154,060 acres; and had, in 1831, a population of 50,239. When 'Domesday' was compiled, it was divided into 13 hundreds: the same number still exists, but the town and port of Hastings, and the antient towns of Rye and Winchelsea, are now separated. The whole rape has 48 parishes. The following are the hundreds:—

33, Baldslow; 34, Battle; 35, Bexhill; 36, Foxearle; 37, Goldspur; 38, Gostrow; 39, Guestling; 40, town and port of Hastings; 41, Hawkesborough; 42, Henhurst; 43, Netherfield; 44, Ninfield; 45, town and port of Rye; 46, Shoyswell; 47, Staple; and, 48, town and parish of Winchelsea.

IV. Chichester rape is situated at the western side of the county, and is bounded on the north by the county of Surrey, on the east by the rape of Arundel, on the south by the British Channel, and on the west by Hampshire. There is an extent of 16 miles of coast, including the headland of Selsey Bill; and from this extreme point to the borders of Surrey the length is 26 miles: the breadth varies from 6 to 10 miles. The barony of Chichester and the rape have followed the same descent as the honor of Arundel, of which they formed a part. It was granted by William to Roger Montgomery, created earl of Arundel and Shrewsbury, a nobleman of extensive possessions in Normandy, who commanded the centre division of the victorious army at the battle of Hastings, and who was nearly related through his mother to the Conqueror. The honor was calculated to contain 84½ knights' fees, or 57,460 acres, and it comprised the city of Chichester and the castle of Arundel. The earl, following the example of the Conqueror, partitioned his property among his sons, and assigned his English honors and possessions to his second son Hugh: from him it passed, in 1098, to his elder brother, Robert, earl of Belesme; but in 1102 it became forfeited to Henry I., in consequence of the earl's revolt. The king settled it on his second wife Adeliza. She subsequently married William de Albini, who, for services rendered Henry II., received a grant of the honor to him and his heirs. It remained in his three lineal descendants; when, on the death of the third without issue in 1243, it passed through the second daughter, Isabel, to John Fitzalan, ninth earl of Arundel and first earl of that house. The Fitzalans continued possessors, except at two short intervals of forfeiture, till 1580, when, on the death of Henry, the twenty-second earl, it became the property of his heiress, Mary, who married Thomas Howard, duke of Norfolk: it has since been forfeited, like other estates of that noble family, but it has been restored, and is now the property of Henry Charles, thirteenth duke of Norfolk and thirty-fourth earl of Arundel. The rape has an area of 145,840 acres; and had, in 1831, a population of 38,929. At the Conquest there were 9 hundreds, besides the city of Chichester: it is now divided into 7 hundreds, one city, and one borough, including 74 parishes. The hundreds are as follows:—

49, Aldwick; 50, Bosham; 51, Box and Stockbridge; 52, city of Chichester; 53, Dumpford; 54, Easebourne; 55, Manhood; 56, borough of Midhurst; and, 57, Westbourne and Singleton.

V. Arundel rape forms the centre of the western division of the county, and is bounded by Surrey on the north, by the rape of Bramber on the east, by the British Channel on the south, and by the rape of Chichester on the west. Its average length from north to south is 20 miles, its width at the sea-coast 15 miles: it is then contracted to nine miles at a distance of seven miles from the sea, but again widens gradually till it has a width of 16 miles on the borders of Surrey. The castle of Arundel was in existence in the Saxon times; and from the Conquest, together with the honor of Arundel, followed the same descent which we have just noticed in Chichester rape. The rape has an area of 132,800 acres, and had in 1831 a population of 31,061. When 'Domesday' was compiled, the rape of Arundel had 8 hundreds, which are now merged in 5 hundreds and one borough, divided into 56 parishes, 21 of which are in the upper and 35 in the lower division. The following are the hundreds:—

58, Borough of Arundel; 59, Avisford; 60, Bury; 61, Poling; 62, Rotherbridge; and, 63, Westeasewrith.

VI. Bramber rape is situated between the rapes of Arundel and Lewes, and extends from Surrey to the English Channel, a length of 22 miles. Along the coast it has a width of eight miles, which is about the average width of the whole rape. The castle was in existence in the Saxon times, and after the conquest it was granted, together with the barony, to William de Braose, in whose family it remained till the death of the tenth of that name, when his daughter Oliva carried the honor by marriage to John de Mowbray, whose descendant in 1398 was created duke of Norfolk; the male heir of that family also failed at the end of ten descents, and the heiress Margaret, who married Sir Robert Howard, carried the estates to the Howards, and laid the foundation of the subsequent splendour of that family. Their descendant is still owner of the honor, and is thus lord of the three rapes which form the western division of Sussex. The rape has an area of 116,650 acres, and in 1831 it had a population of 30,113. In the Conqueror's time there were 11 hundreds in this rape, and there are the same number now, but the boroughs of Bramber, Horsham, New Shoreham, and Steyning, are now separated: the whole is subdivided into 40 parishes. The hundreds are as follows:—

64, Borough of Bramber; 65, Brightford; 66, Burbeach; 67, East Easewrith; 68, Fishersgate; 69, borough of Horsham; 70, borough of New Shoreham; 71, Patching; 72, Singlecross; 73, Steyning; 74, borough of Steyning; 75, Tarring; 76, Tipnoak; 77, West Grinstead; and, 78, Windham and Ewhurst.

There are parts of the county which have their particular liberties exempt from the jurisdiction of the county magistrates: 1, the city of Chichester; 2, the liberty of the Cinque Ports, which is partly in this county and partly in Kent. The part which is in this county comprises—1, the town and port of Hastings, including the whole of the parishes of All Saints, St. Clements, St. Mary in the Castle, St. Michael, the Holy Trinity, St. Mary Bulverhithe, and St. Leonard's, Winchelsea; and parts of the parishes of St. Mary Magdalen and St. Leonard, and the liberty of the Sluice, in the parish of Bexhill; 2, the dependants of Hastings, viz. Seaford and Pevensey, the latter of which includes the parishes of Pevensey and Westham, and part of the parish of Hailsham; 3, the antient town of Rye, which includes nearly one-half of the parish; and 4, the antient town of Winchelsea, including the whole parish of St. Thomas the Apostle, and parts of the parishes of Pett, Broomhill, and Icklesham. [Cinque Ports.] The hundreds of Battle and of Bexhill, in the rape of Hastings, are also franchises, and the inhabitants are exempt from service on juries for the county.

There is only one city in the county, the city of Chichester: one Cinque Port, Hastings; two antient towns added to the Cinque Ports, Rye and Winchelsea; two members of the Cinque Ports, Pevensey and Seaford; the parliamentary boroughs of Arundel, Brighton or Brighthelmstone, Horsham, Lewes, Midhurst, Shoreham or New Shoreham; the antient boroughs of Bramber, East Grinstead, and Steyning; the market-towns of Battle, Cuckfield, Hailsham, and Petworth, and the towns of Bognor, Eastbourne, Mayfield, Newhaven, and Worthing. Of some of these places an account is given elsewhere. [Arundel; Battle; Bramber; Brighthelmstone; Chichester; Hastings; Lewes; Rye; Seaford; Shoreham.] The others are noticed here.

Winchelsea is locally situated in the hundred of Guestling and rape of Hastings, 67 miles from London. According to the editor of 'Magna Britannia,' the name is derived

from the Saxon *wincel*, an angle or corner, and *sea*, or *ea*, island: this explanation well suits the situation of Old Winchelsea, which, before the reign of Henry III., was washed by the waters of the Channel on the south and east, and by the Rother on the north. Of its early history little is known, except that it was of some importance in Saxon times, and that, like its neighbour Rye, it was granted by Edward the Confessor to the abbot and monks of Fescamp in Normandy, which grant was confirmed by William I. and Henry I.; but Henry III., in the 31st year of his reign (1247), resumed possession of it for the better defence of his kingdom, exchanging for it other manors in Gloucestershire. The town is not mentioned by name in 'Domesday,' where the possessions of the abbey were entered under the manor of Rameslie; Winchelsea is probably the new borough there noticed. At the Conquest it did not form part of the Cinque Ports, but was added before the reign of John. [CINQUE PORTS.] In 1067 William landed here from Normandy, and by his sudden arrival defeated the measures taken in England to shake off the Norman yoke: here also Henry II. landed in 1188, on his return from Normandy: hither Simon de Montford repaired after the defeat of his father at Evesham, intending to bring over foreign troops; and hither he was followed by Prince Edward, who, in 1266, stormed and took the town, putting to the sword the chief inhabitants, who had warmly espoused the cause of the barons. Soon after the exchange with the abbey, the old town began to suffer much from the influx of the sea. More than 300 houses were destroyed by the overflow of the sea in 1250. The sea continued its ravages, and had done so much injury, that the inhabitants petitioned Edward I. for a site whereon to build a new town; and the king, in the 8th year of his reign, issued a commission to Ralph of Sandwich, his steward, authorising the purchase of a rising hill or piece of ground containing 150 acres, which was then a rabbit warren, called Iham, within the parish of Icklesham. The purchase was completed, an arrangement was made with the vicar to pay him 10*l*. in lieu of tithes, and the 'inhabitants of Old Winchelsea took to it by little and little and builded it.' The ground was divided into 40 squares, containing about 2¼ acres each, of which 39 may still be traced; and the spacious streets intersected each other at right angles. The new town was walled in by the king, and in six or seven years it was 'metely well finished.' Very soon afterwards the calamity, against which the inhabitants had provided, happened. 'In the year of our Lord 1287, in the even of St. Agath, the virgin, was the towne of Winchelsea drowned, and all the lands between Clivesend (Cliff's End, Pett) and the vocher of Hithe.' The new town continued to increase and flourish; its relative importance may be known from the large proportion of ships furnished to Edward I. Hastings and its members, with the two antient towns, had to furnish the king with 21 ships, and in the apportionment no less than 10 were assigned to Winchelsea, 5 being required from Rye, and only 3 from Hastings. It soon became the place of import for French wines, for which massive crypts were built. The harbour was little injured by the overflow that destroyed the town, and in the time of Henry VI. Winchelsea was one of the principal ports of embarkation for the Continent.

The new settlement did not escape without the ordinary calamities of towns along the southern coast: it was pillaged and partially burnt by the French in 1360, and received much more serious injury from the Spaniards twenty years afterwards. The town was subsequently repaired. Henry VIII. raised for its defence the castle of Camber, the ruins of which are still standing: it consisted of a large round tower, which served as a keep, surrounded by several smaller ones connected by short curtains. The sea, which had been the constant enemy of Winchelsea, began once more to cause its ruin by deserting the new town; the inlet and harbour became choked up with sand and beach, and although Queen Elizabeth, who visited it in one of her progresses in 1573, manifested her sense of its importance by calling it Little London, the trade was soon entirely lost, and Winchelsea fell into decay. It is now little more than a village; the houses round two sides of the principal square and one small square with a few houses alone remain. In the middle of the last century an attempt was made to establish here a manufactory of cambric, for which an act was obtained (4 Geo. III., c. 37), but the attempt failed. A manufactory of Italian crape succeeded, till it was transferred to Norwich. At present there is no manufacture and very little trade: the population, in 1831, was reduced to 772, inhabiting 143 houses. Winchelsea has never received a charter: it is a corporation by prescription, and was not included in the act of 5 & 6 Wm. IV., c. 76. The corporation consists of a mayor and jurats, of whom there ought to be twelve; the style is 'the mayor, jurats, and commonalty of the antient town of Winchelsea.' The mayor and jurats hold courts of session and general gaol delivery, and their jurisdiction extends to capital felonies. This town returned two members to parliament from 42nd Edward III. till the 2nd Wm. IV., c. 45, when Winchelsea found a place in Schedule A, since which it has been added to the electoral district of Rye, and joins in the return of one member. Of the antient glory of Winchelsea few traces remain. Three of the four gateways are still standing, viz. the Landgate on the north-east, the Strandgate on the south, and Newgate to the south-west, but in a very ruinous condition. Of the three churches, St. Giles, St. Leonard's, and St. Thomas the Apostle, a portion of the last alone exists. It was a large cruciform structure, but the nave has long since disappeared; the north and south transepts are in ruins, and the chancel with two aisles is the only part used for public worship. Three lofty Gothic arches of clustered columns, formed partly of Sussex marble polished, separate the aisles; the walls are fretted with arches and columns, and the windows are in the pointed style. In this church are three altar-monuments, of the time of Edward I., of secular warriors in mail armour, with their legs crossed in token that they had assumed the cross and marched to the defence of the Christian faith in Palestine. They resemble the tombs in the Temple church, London, and, like them, have been erroneously supposed to be monuments of the Knights Templars. The Templars were always buried in the habit of their order, and are represented in it on their tombs. This habit was a long white mantle, with a red cross over the left breast; it had a short cape and a hood behind, and fell down to the feet unconfined by any girdle. By the arms on the shield of one knight, it appears to be the tomb of a member of the family of Oxenbridge, and another probably belonged to Gervase Alard, both distinguished families in the town or neighbourhood in the time of the last crusade. Besides the churches, Winchelsea had a convent of Grey Friars, founded by William de Buckingham, of whose edifice the choir with beautiful arches and fine Gothic windows yet stands. Here was also a convent of Black Friars or Dominicans, and a preceptory of St. Anthony: of these all traces are lost. The living is a discharged rectory, within the archdeaconry of Lewes, of the average net value of 278*l*. per annum. Robert de Winchelsea, made archbishop of Canterbury in 1291, and celebrated for his learning, his charity, and his firmness, was a native of Winchelsea.

Pevensey, which gave its name to the rape, and was once formidable for its castle and useful for its harbour, is now an insignificant village with only 49 houses, and had, in 1831, a population of 343. It is 60 miles from London. The Saxon name was Pevensea, and the Norman Peovensels. Its first authentic mention in history is in 792, when it was given, together with Hastings, by Berodaldus, one of the generals of King Offa, to the abbey of St. Denis at Paris. In the reign of Edward the Confessor it had only 24 burgesses, and yet the port was of sufficient importance to be ravaged by Earl Godwin and his son Harold in 1043, when many ships were taken: it was at that time one of the chief ports for communication with France and Flanders. In the bay of Pevensey William the Conqueror landed with his army from Normandy prior to the decisive battle of Hastings; and it was this port which Swane, son of Earl Godwin, entered with eight ships on his return to England after his abduction of the abbess of Leominster. In the reign of Henry III. the port was still available, but it soon afterwards fell into decay owing to the withdrawal of the sea: the original outlet is now choked up, and the water drained through the beach by means of a sluice. Pevensey, like other places on the southern coast, has been claimed as the site of the antient British city of Anderida, with little more than conjecture to support the claim. The only object of interest is the castle, of which many interesting remains exist. The outer work contains many Roman bricks, and much of what is called 'herring-bone work,' from which it has been inferred that this was a Roman fortress. No mention is made of its existence in the Saxon times; but, if not erected by the Romans, it was certainly built from the remains of an older fortress. The

outer walls, which constitute the most antient part of the fortification, enclose a space of seven acres, and are from 20 to 25 feet high. The moat on the south side is still wide and deep; on the other sides it has been filled up. The entrance is on the west or land side, between two round towers, over a drawbridge. Within the walls is another and much more modern fortification, approaching a pentagonal form, with five nearly circular towers, moated on the north and west. It is entered from the outer court by a drawbridge on the west side between two towers. The principal barbican or watch-tower is not at the entrance, but towards the north-east corner. The walls are nine feet thick, and the towers were two and three stories in height. The castle was of great strength: it withstood the attacks of William Rufus's army for six days, protecting Odo, bishop of Bayeux, who ultimately yielded only for want of provisions; and it afterwards successfully resisted the siege of King Stephen, who personally superintended the attack, but met with so gallant an opposition from Gilbert, earl of Clare, that he was obliged to withdraw his forces, leaving only a small body to blockade it by sea and by land. It once more resisted hostile attacks, when it was fruitlessly assailed, in 1265, by Simon Montford, son of the renowned earl of Leicester. Again, when Sir John Pelham was in Yorkshire, in 1339, assisting Henry, duke of Lancaster, to gain the crown, the castle, left under the command of Lady Jane Pelham, was attacked by large bodies of the yeomen of Kent, Surrey, and Sussex, who favoured the deposed king Richard, and was bravely and successfully defended by Lady Jane. The castle remained as a fortress till the reign of Elizabeth; two antient culverins, one of which bears her initials, are yet preserved: after which its history is not traced till the parliamentary survey of 1675, when the castle was in ruins, and the ground within the walls was cultivated as a garden. Pevensey is a member of the Cinque Port of Hastings [Cinque Ports], and the liberty includes the parishes of Pevensey and Westham, and 500 acres in the parish of Hailsham. It never had a charter, but is a corporation by prescription, left untouched by the act 5 and 6 Wm. IV., c. 76. It consists of a bailiff and jurats; the style is 'The bailiff, jurats, and commonalty of the town and liberty of Pevensey.' The bailiff and jurats hold courts of session and general gaol delivery four times a year, and have jurisdiction in capital felonies, which has not been exercised of late years. The inhabitants had formerly an hospital dedicated to St. John, long since lost. Of the church dedicated to St. Nicholas, the patron saint of the sailors, a portion only remains. The benefice is a vicarage, in the archdeaconry of Lewes, and deanery of Pevensey, of the annual net value, as returned in 1835, of 948*l.* There is an endowment of 100*l.* a year for almshouses, and a school for girls held every day in the church, and there is also a day-school for 50 or 60 boys. The famous physician Andrew Borde, better known as 'Merry Andrew,' was born at Pevensey.

Horsham, a parliamentary borough and market-town in the rape of Bramber, is situated on the Forest Ridge, near the borders of the county of Surrey, at a distance of 35½ miles south-south-west from London. The area of the parish is one of the largest in the county, comprising 8500 acres, exclusive of the portion on which the town itself is built. The name is evidently taken from *hurst*, Saxon, a wood, and *ham*, a town, although some have derived it from Horsa, brother of Hengist, who was killed in 457, and said to have been buried in the vicinity of the town. The town consists of two streets crossing each other at right angles, with an open space in the centre, in which stands the court-house, a handsome stone building, enlarged by the duke of Norfolk in 1799, for the judges of assizes, who held the spring assize here from that period till 1830: the Midsummer quarter-sessions for West Sussex are still held in this hall. In this town also is the county gaol, rebuilt on the plan of Howard in 1775. Each prisoner was to have a separate cell, and the debtors and felons were to be kept separate, with a day-room on each floor, and a chapel and an infirmary. Here was attempted the earliest of the improvements in prison discipline, and here separate confinement was first systematically resorted to with the most beneficial effects. Since the great improvement in the House of Correction at Petworth, there have been few committals to Horsham gaol, and it is now chiefly used for debtors and for persons convicted. A corn-market, well attended, is held on Saturdays. Horsham is a borough by prescription, and returned two members from the 23rd Edw. I. till the passing of 2 Wm. IV., c. 45, when the borough found a place in Schedule B, and has since returned one member. The old right was in the owners of some twenty-five burgage tenements; the whole parish is now included: the number of voters in 1832 did not exceed 257; but the number increased in 1839-40 to 345 occupiers of 10*l.* houses and six burgage tenants. The church, dedicated to St. Mary, is a spacious and elegant building, with a lofty tower surmounted by a spire, in the early English style of architecture. The benefice is a vicarage, in the archdeaconry of Chichester and deanery of Storrington, of the annual net value, in 1835, of 651*l.* The population in 1831 was 5105. There is a school for 60 children of poor people, to be taught reading, writing, and arithmetic, and, at the discretion of the school-wardens, the Latin language, founded by Richard Collier in 1532, with a good school-house and dwellings for a master and usher. There is also a Lancasterian school for 200 boys and 100 girls, and an infant-school supported by voluntary contributions.

Midhurst is a parliamentary borough and market-town in the rape of Chichester. It is pleasantly situated on a gentle eminence, surrounded by loftier hills overlooking the meandering course of the river Rother as it flows towards the Arun: it is 50 miles from London, and on the high-road from Winchester to Petworth, from which place it is distant 6½ miles. Midhurst is supposed to be the Mida of the Romans with the Saxon termination added: at the time of the Conquest it formed part of the barony of Arundel; but in the reign of Henry I., four and a quarter knights' fees were erected by the king in favour of Savaric de Bohun, into the minor lordship of Midhurst, which was held for several generations by that powerful family. After the extinction of the male line of the Bohuns, the lordship was granted by Henry VIII. to Sir Anthony Browne, standard-bearer to that king, whose son was created Viscount Montague. In his descendants the property remained till the death of George Samuel, the eighth Lord Montague, in 1793, when it passed to his sister Elizabeth Mary, who married William Stephen Poyntz; and on his death, in 1840, it became the estate of his two daughters, one of whom married Captain Frederick Spencer, brother of Earl Spencer, and the other the marquis of Exeter. On a mound on the south bank of the Arun are the ruins of the castle long occupied by the Bohuns: the whole vallation, now overgrown with trees, lies within a circumference of 400 yards. Within the walls was a chapel dedicated to St. Anne. There is a corn-market, well attended, held every Thursday, and a town-hall in which the western sessions were formerly held. Midhurst is a borough by prescription, and returned two members to parliament from 4th Edward II. till 1832, when, by the act 2 Wm. IV., c. 45, the number of representatives was reduced to one; and to make up a constituency a widely-extended agricultural district, consisting of seven entire parishes and eleven portions of parishes, was added. The old right was in the holders of burgage tenements, of which there were forty four, and the borough was memorable from the fact that the site of many tenements was marked by stones in the park wall, the buildings having been long destroyed. In 1768 this borough gave his first seat to Charles James Fox, then only nineteen years of age. The new district only furnished 252 registered electors in 1832, and in 1839-40 there were only 261. The church, dedicated to St. Denis, is a small and plain stone edifice in the later style of English architecture: it stands in the centre of the town. The benefice is a perpetual curacy, in the archdeaconry of Chichester, and the head of the deanery of Midhurst, endowed with 400*l.* private benefaction, and 600*l.* royal bounty: the average net value per annum, in 1835, was 170*l.* There is a free grammar school for 12 boys, founded by Gilbert Hannam in 1672, and a national school, well supported. The population in 1831 was 1478. About one quarter of a mile east of Midhurst stood the stately pile of Cowdray House, the princely seat of the Montagues, built in the reign of Henry VIII., and destroyed by fire in 1793.

East Grinstead, which is the largest parish in the county, containing upwards of 15,000 acres, is a market-town situated in the rape of Pevensey, near the borders of Ashdowne Forest, on the high road from London to Lewes, at a distance of 28 miles from London. The town is pleasantly placed on a considerable eminence, but consists only of one principal street, irregularly built. There

is a market for corn on Thursdays, and a cattle-market on the last Thursday in the month. When the roads in Sussex were scarcely passable in winter, East Grinstead, as one of the nearest points to the metropolis, was selected for the holding of the Lent assizes, but the practice was discontinued in 1799, and Horsham chosen instead, the gaol being there. East Grinstead is a borough by prescription, and returned two members to parliament from 1st Edw. II. till the passing of the act 2 Wm. IV., c. 45, when it found its place in schedule A. The old right was in the owners of the burgage tenements, of which there were thirty-six. At the east end of the town is a quadrangular stone building, used as a college for twenty-four aged persons of both sexes, who, under the government of a warden and two assistants, have each a separate apartment, and an allowance of 8*l.* a year. The college was founded by Robert, second earl of Dorset, and was erected in 1616. The endowment is 330*l.* a-year. Within the walls is held a free grammar-school, founded in 1708 by Robert Payne, at which twenty-five boys are educated. In this parish stand the ruins of Brambletye House, built in the reign of James I. by Sir Henry Compton, from an Italian model; but it soon fell to decay from the neglect of its subsequent owner. In this parish also is Kidbrooke, built for William, forty-second baron of Abergavenny, by Mylne, the architect of Blackfriars-bridge: it was sold in 1805 to the Hon. Charles Abbott, afterwards Lord Colchester. The church, which is a handsome stone edifice, with an embattled tower surmounted by light pinnacles, stands on the east side of the High-street. It is in a pure style of Gothic architecture, and was erected in 1786. The benefice is a vicarage, in the archdeaconry of Lewes, of the annual net value, in 1835, of 340*l.* The population in 1831 was 3364.

Steyning, a borough by prescription, and a market-town, in the rape of Bramber, 50 miles from London. The town stands at the foot of one of the escarpments of the Downs, about a mile to the westward of the river Adur, and consists of a wide street running in a north-westerly direction, from which branches another running north-east; on the south side of the latter were situated the burgage tenements of the borough of Bramber, so that what appeared to be one small town returned four members to parliament. This town was called by the Saxons Steningham, from *stean*, a stone; and the ancient Roman road of Stane-street passed through the town. At the time of the Conqueror's survey Steyning belonged partly to the abbey of Fescamp, and partly to William de Braose, lord of Bramber. The abbot held the property till the dissolution of alien priories by Henry IV., who granted it to the newly-founded monastery of Sion in Middlesex; but on the dissolution of the greater monasteries the property passed to the Pellatts, and has since come to the Gorings. There is a well-supplied cattle-market held on every alternate Monday, which is a large mart for the sheep bred in West Sussex. Steyning returned two members to parliament in the 4th Edward II., but was joined with Bramber from that time till 31st Henry VI., when it returned its members separately, till disfranchised by the act 2 William IV., c. 45. The church, dedicated to St. Andrew, was originally a cruciform structure: of the original the nave only remains, the rest being a more modern erection. The nave was built in the Saxon times, or at a very early period of the Norman; the interior is magnificently enriched, the whole of the arches, as well as the capitals on the large cylindrical pillars, being profusely ornamented with tiers of mouldings of great variety and beauty. Ethelwulf, the father of Alfred the Great, is said to have been buried in Steyning church. The benefice is a vicarage, in the archdeaconry of Chichester, and deanery of Storrington, of the average net value, in 1835, of 308*l.* A school for boys, to be instructed in the Greek and Latin tongues, and in the principles of the established church, was founded by William Holland in 1614. The population in 1831 was 1416.

Cuckfield is situated in the northern part of the hundred of Buttinghill, in the rape of Lewes, 37 miles from London, on the high road to Brighton. It is a small neat town, with a market on Fridays, granted by charter of James II. The manor formed part of the barony of Lewes, and passed from the Warrens to the Fitzalans; one-half remains, like the barony, in the Abergavennys, and the other, through an alienation to the Coverts, is the property of the Sergisons. The church, dedicated to the Holy Trinity, is a large building in the decorated style of English architecture, with an embattled tower surmounted by a lofty spire. The benefice is a vicarage, in the archdeaconry and deanery of Lewes, of the average net value, in 1835, of 414*l.* The free grammar-school was founded by Edward Fowler in 13th Henry VIII. William Spencer increased the endowments, and Lady Dorothy Shirley built a school-house near the churchyard: the scholars at present on the foundation are very few. The population in 1831 was 2586.

Hailsham is a small town in the hundred of Dill and rape of Pevensey, 54 miles from London on the high road to Eastbourne. The population in 1831 was only 1645. It has one of the largest markets in Sussex for sheep and cattle, held on every alternate Wednesday, its proximity to the rich pastures of Pevensey Level making it extremely favourable as a mart. The town is built on a gentle acclivity rising from the Levels. At Otham, in this parish, a religious house for monks of the Premonstratensian order was founded by Ralph de Dene and Sibilla his wife, but it was afterwards moved to Bayham. A few traces of the old walls alone mark the site. The church is in the later style of English architecture, with an embattled tower surmounted by light pinnacles. The benefice is a vicarage, in the archdeaconry of Lewes, and deanery of Pevensey.

Petworth is a market-town in the hundred of Rotherbridge and rape of Arundel, 49 miles south-west by south from London, on the high road to Arundel and Chichester. It is situated on an eminence above a small stream near the river Rother, from which it is supplied with water, raised by works erected by the late earl of Egremont. The property originally formed part of the honor of Arundel, but was given by Adeliza, dowager queen of Henry I., to her brother Joceline de Louvaine, from whom it passed to the noble family of the Percys, lords of Petworth, and afterwards earls of Northumberland, and ultimately devolved upon Elizabeth, baroness Percy, only daughter and heiress of Joceline, eleventh earl. She married Charles Seymour, duke of Somerset, and her daughter Catherine carried the estates to the Wyndhams. The mansion of the Percys backs upon the churchyard. In 1309 Henry de Percy had a licence and embattled his house at Petworth; the house was new-fronted by the duke of Somerset, and greatly altered by the late possessor, George O'Brien, earl of Egremont, who adorned its galleries with the rarest specimens of ancient and modern sculpture, and added to the already rich collection of pictures. A market is held on Saturdays. The market-place and court-house is in the centre of the town: it is a neat stone building, erected at the close of the last century by the earl of Egremont, and here are held the Easter and Epiphany sessions for the western division of the county. One of the first results of the philanthropic Act of 1782 for regulating prisons, procured at the instance of Mr. Howard, was the building, in 1785, of the house of correction at Petworth. It was built on two stories, over arcades: there was a cell for each prisoner, and the system of separate confinement was pursued here as successfully as at Horsham till the year 1816, when, in consequence of the increase of prisoners on the termination of the war, the structure of the prison was altered, and the prisoners were employed in the factory. The church, dedicated to St. Mary, was erected about the time of Henry VII., and is a cruciform structure in the decorated style, to which an elegant spire has been added. The benefice is a rectory, in the deanery of Midhurst, and in 1835 the average net income was 856*l.* There are almshouses for 12 aged people, founded in 1624 by Thomas Thompson, but the number has been increased to fourteen, who each receive house-room and an allowance of 20*l.* a-year. There is also a splendid endowment for twelve poor widows, founded in 1746 by Charles, duke of Somerset, and by a liberal interpretation of the terms of the endowment by the late earl of Egremont, between 700*l.* and 800*l.* are annually given in support of forty-eight females, of which twenty-two are in the almshouses. There is a school for twenty poor children, founded in 1753 by Richard Taylor, and the earl of Egremont added in 1834 an endowment for twenty-five boys, to be taught gratis on the national system, and for fifteen more on payment of 2*d.* a-week; and also in 1833 an endowment for like numbers of girls, on similar conditions. The population in 1831 was 3114.

Bognor is a retired watering-place in the western part of the county: it is locally situated within the parish of South-

norsted, in the hundred of Aldwick and rape of Chichester, 67 miles from London. It owes its origin to Sir Richard Hotham, who in 1784 began to erect houses for visitors, and it has been much frequented of late years. The promenade is extensive, and the houses neat. The Bognor rocks, which are only visible at low-water, extend into the sea in a curved direction for two miles. Within the memory of man they formed a line of low cliffs along the coast. The lowest part of the rocks is a dark grey limestone, in some instances passing into sandstone; the upper part is silicious. The population in 1831 was 2190.

Eastbourne is a pleasant bathing-place. It is situated at the foot of the eastern extremity of the Downs, at a distance of 61 miles from London, and about two miles to the eastward of Beachy Head, on the shores of what is known as Pevensey Bay. The antiquity of Eastbourne is beyond a doubt. It was a station of the Romans, and in 1717 a Roman pavement of white and brown tesseræ, 17 feet 4 inches by 11 feet, and a bath, 16 feet long, 5 feet 9 inches broad, and 2 feet 9 inches deep, were discovered. From the existence of these remains and from its situation it was supposed by Dr. Tabor to be the site of the antient town of Anderida Portus, a station founded by the Romans on the southern coast to check the predatory Saxons; and which has been placed by Camden at Newenden in Kent, by Mr. Elliott at Seaford, and by other antiquaries at Pevensey. It was at Anderida that Ella, after having defeated the Britons at Mercreadesburne, massacred every man, woman, and child, and destroyed the town, which, we are told, was never afterwards rebuilt. Towards the close of the last century Eastbourne attracted notice as a watering-place. The bathing is excellent, the water clear and pellucid, and the sands are dry and extensive. At Holywell, near Eastbourne, there are chalybeate springs, where the water does not materially differ from that at Clifton. The ruins of a domiciliary of a brotherhood of Black Friars are still standing. The church is a spacious building, consisting of a nave with side aisles, a large chancel, and lofty antique tower. The living is a vicarage, in the archdeaconry of Lewes, of the annual commuted value of 550*l.* The population in 1831 was 2726. The South Downs abound with that delicate bird the ortolan, or wheat-ear, and large numbers are caught near this town. Beachy Head, which has been before noticed, has been the scene of two unfortunate encounters to the English: one in 1690, between the combined fleets of England and Holland, under Herbert, earl of Torrington, against the French, an engagement from which Lord Torrington was forced to retire; and the other, in 1706, between three line-of-battle ships —the Royal Oak, the Grafton, and the Hampton Court, which were convoying several merchantmen, and a fleet of nine ships and several privateers, under the command of the famous corsair Du Guay Tronin. The Grafton and the Hampton Court were taken, and the third vessel only saved by being run on shore. The official account, hitherto unpublished, of the disastrous retirement of Lord Torrington from the action in 1690, is preserved among the Ellesmere MSS. at Bridgewater House.

Mayfield is situated on high ground, in the rape of Pevensey, and in the hundred of Loxfield-Camden, 44 miles from London. It is now only a small agricultural town, of one street; but the parish is extensive, including 13,500 acres. The town is remarkable for the palace of the archbishops of Canterbury, who had convenient residences provided for them at easy distances within the South Saxon diocese. The erection of the palace at Mayfield, as well as of the former wooden church destroyed by fire in 1389, is ascribed to the famous St. Dunstan; and in that portion of the palace which is now standing are preserved the saint's forge and anvil, and the very traditionary tongs with which this most reverend prelate seized the arch-enemy of mankind. Mayfield was a favourite residence of the archbishops. Provincial synods were held here in 1332 and 1362, and Archbishops Mepham, Stratford, and Islip died here. Of the antient palace the walls and three noble arches in the hall, and some portions of the chambers, one of which bears the date of 1371, are in existence. They are of later date than the time of St. Dunstan. The palace and manor were surrendered by Archbishop Cranmer to Henry VIII., who, in 1545, granted them to Sir Edward North: they were afterwards alienated to the Greshams, and here Sir Thomas Gresham, the prince of merchants, resided in much magnificence, and entertained in one of her progresses Queen Elizabeth. The church built after the destruction of the wooden pile is still dedicated to St. Dunstan: it is a large building with a lofty spire. The living is a vicarage: it was an appendage to the conventual establishment of the Black Canons at South Malling, and is now a peculiar of the Archbishop of Canterbury, and the annual net value, as returned in 1835, was 834*l.* The population of the parish in 1831 was 2738. Thomas May, the historian of the long parliament, was born at the palace at Mayfield, in 1595.

Newhaven is a small and neat town, near the centre of the county, and the south-eastern corner of the rape of Lewes, in which it is situated, at a distance of 56 miles from London. The antient name of the town was Meeching, but when the channel of the Ouse was diverted from Seaford and made to enter the sea in a straight line southward, the old name was changed. At what period this occurred is not ascertained: it must have been anterior to the time of Elizabeth, for the haven at Seaford was then decayed. The town consists of one main street, with two smaller ones at right angles, built on the western side of the river, and one mile from the sea. The harbour is the sole cause of its importance, and it is much frequented, being by far the best tidal harbour between Portsmouth and the Downs. The harbour has been already described. [SEAFORD.] The mouth is protected by a battery on the heights near Castle Hill, where there are the remains of an ancient circular fortification large enough to have contained 5000 men. The river is crossed by a drawbridge, erected in 1784. The inhabitants are chiefly occupied in maritime pursuits, and shipbuilding has been prosecuted with success. There is a custom-house, and large bonding warehouses for corn and wines. The chief imports consist of coals, timber, corn, wine, and spirits, and there is also a good coasting-trade in flour and butter. The exports are very limited, most of the vessels going out in ballast. The church stands on a hill to the west of the town: the nave is modern, but the round eastern wall of the chancel marks its Saxon origin. The benefice is a discharged rectory, in the archdeaconry of Lewes, with an average net income, in 1835, of 186*l.* The population in 1831 was 904.

Worthing is a modern and healthy watering-place, locally situate within the parish of Broadwater, in the hundred of Brightford and rape of Bramber, 56 miles from London. The situation is low and flat, only a few feet above the level of the sea, and it is foggy in winter. The sands extend for some distance, and in the summer there is good bathing. Not many years ago it was an obscure fishing-station, but at the close of the last century, when fashion caused the best points of the southern coast to be resorted to for health and pleasure, this town sprung up, and in consequence of its proximity to the Downs and the richness of the surrounding country, it has continued to increase. An act for paving and lighting was obtained in 1803, and a chapel-of-ease built in 1812. The streets and squares are well built, and the houses convenient, but not large. The esplanade extends for three-quarters of a mile along the shore. In the neighbourhood, and particularly on Lancing Down, Roman remains have been found, and at Cissbury is a fortification or earthwork of an irregular oval form, enclosing an area of nearly 60 acres. Indications of its having been used by the antient Britons have been discovered, and the finding of Roman coins within the rampart proves its occupancy by the Romans. The population of the parish, in 1831, was 4576.

Tarring near Worthing was the birth-place of John Selden.

Divisions for Ecclesiastical and Legal Purposes.—The whole of the county, with the exception of 21 parishes, is within the diocese of Chichester. It is subdivided into two archdeaconries, Chichester and Lewes. The archdeaconry of Chichester has 5 deaneries, Arundel, Boxgrove, Chichester, Midhurst, and Storrington, embracing 133 parishes, all within the western division of the county. The archdeaconry of Lewes forms the eastern part of the county, and has 4 deaneries, viz. Dallington, Hastings, Lewes, and Pevensey, including 144 parishes. There is also the deanery of Battle, exempt from the archdeacon's jurisdiction, and including the parish of Battle. The peculiars of the archbishop of Canterbury are the deaneries of Malling and Pagham, the former having 12 parishes and the latter 8 parishes; and one parish within the archdeaconry and city of Chichester.

Sussex is in the Home circuit. The assizes are now held at Lewes, where there is a house of correction: the county gaol is at Horsham. For subordinate jurisdiction, the county is divided into East Sussex and West Sussex, the former comprehending the rapes of Hastings, Lewes, and Pevensey; and the latter the rapes of Arundel, Bramber, and Chichester. The justices of the peace, though by their commission appointed for the whole county, confine the exercise of their power to their division of it. Separate quarter-sessions are held; for East Sussex at Lewes, and for West Sussex a day or two afterwards, the Epiphany and Easter sessions at Petworth, the Trinity at Horsham, and the Michaelmas at Chichester. There are also eleven petty-sessions held for East Sussex at different places within that division, viz. Battle, Brighton, Burwash, Cuckfield, East Grinstead, Frant, Hailsham, Hastings, Lewes, Rye, and Uckfield; and seven petty-sessions for West Sussex, viz. Arundel, Chichester, Horsham, Midhurst, Petworth, Steyning, and Worthing.

From the 1st Edward I. to 12th Charles I. the counties of Surrey and Sussex were united under one sheriff, but they are now divided.

The same two great divisions of East and West Sussex are, since the county has been divided by the Reform Act, used for parliamentary purposes. East Sussex returns two members: the election takes place at Lewes, and the nine polling-places are Battle, Brighton, Cuckfield, East Grinstead, Hailsham, Hastings, Lewes, Mayfield, and Rye. West Sussex also returns two members: the election takes place at Chichester, and the seven polling-places are, Arundel, Chichester, Horsham, Midhurst, Petworth, Steyning, and Worthing. Two members each are returned by the city of Chichester, the Cinque Port of Hastings, and the boroughs of Brighton, New Shoreham, and Lewes: and one member each for the antient town of Rye, and the boroughs of Arundel, Horsham, and Midhurst. The total number now returned from the whole county is eighteen. Before the Reform Act it was twenty-eight. By that Act Bramber, East Grinstead, Seaford, Steyning, and Winchelsea, returning two members each, were disfranchised, and Arundel, Horsham, Midhurst, and Rye reduced from two members each to one, making a deduction of fourteen members; but the loss was diminished by the division of the county and the creation of the new borough of Brighton.

History and Antiquities.—This county, like the adjoining county of Kent, comprehends that part of England which, from its proximity to the Continent, first attained notice, but its name is derived from the kingdom erected by Ella, after his successful expedition in 477, when he assumed the title of king of the South Saxons, and gave the title of Suth-sex to the district.

The maritime coast of England was inhabited in the time of Cæsar by a rude but warlike people, the Belgæ; that they were numerous in Sussex, and held the district with ample defences and fortifications, is evident from the remains of their works. They had indeed a regular chain of communications along the hills from one end of the county to the other. The principal posts were at the extremity of some point nearly surrounded by water, and often defended on the land side by a vallum and trench. The towns of Arundel, Bramber, Lewes, and Seaford were thus conveniently placed. They had also stations at short distances on all the ground which was not covered with the immense forest or Coitandred constituting the Weald of Sussex. At Storrington, at Sullington, at Ditchelling, at Lewes, at Cissbury above Worthing, and indeed on almost all parts on or near the slopes of the Downs, the remains of antient British earthworks have been traced. The pottery is of the coarsest and rudest kind, being nothing more than the bluish-grey clay of the country moulded by the hand; ornamented by the indentations of the fingers or by oblique strokes or gashes made by some blunt instrument, and then dried in the sun without fire. Perhaps still stronger evidence of the number of the antient Britons may be found in the preservation in the county of many names of places either pure British, as Glynde (*glyn*, a vale), or mixed with the Saxon, as Pen-hurst (*pen*, a head), Cuck-field (*coc, princeps*), and Southease (*ise*, a river), and the retention of many words not generally in use elsewhere. Of the eight principal British roads, one only entered Sussex—the Ermyn Street; one branch from London entered this county at Pulborough near Horsham, running to Chichester on the west, and the other branch went through the eastern part of the county by Wadhurst, Mayfield, and the neighbourhood of Beachy Head, or, as conjectured with much reason by Dr. Stukely, through East Grinstead to Isfield, Lewes, Southease, and Newhaven, in all of which places there are antient encampments and British names.

On the first landing of Cæsar in Britain, he does not seem to have set foot in this county; and it was not till nearly a century afterwards, A.D. 47, when Vespasian received his commission to reduce the maritime districts, that Sussex fell under the Roman sway. This being accomplished, he left the government to a British prince, Cogi, afterwards named Cogidubnus, who, if he did not found the city of Regnum, now called Chichester, made it the chief seat of his government, which included Hampshire and Sussex. In his descendants the civil and military government of the southern coasts is said to have remained till the death of Lucius, the legendary founder of Christianity in Britain.

The Romans however being now supreme, three large towns or fortresses sprung up along the coasts of Sussex, Regnum, Mutuantonis, most probably Lewes, and the third Anderida. There were also smaller and intermediate stations for convenience in journeys, or for the purpose of defence. Of the site of Regnum there is no doubt; for in digging the foundation for the present council-chamber at Chichester in 1723, the foundation of a temple was discovered, with an inscription, showing that it was dedicated to Neptune and Minerva by a company of artificers, by authority of Cogidubnus, Claudius being legate in Britain. Other Roman inscriptions have been from time to time brought to light; among them one by Lucullus, who acted as proprætor after Agricola's recall; and many tesseræ and Roman coins have been dug up; and there is on a place called the Broil, on the north side of the city, an extensive earthwork or castramentation, which has every appearance of having been made or materially altered by the Romans.

The fifteenth Iter of Richard of Cirencester proceeds coastwise from Regnum through the eastern part of the county into Kent. The first station mentioned east of Regnum is called Ad-decimum, the name designated its distance from Regnum, and in 1811 the exact spot was fixed at Bignor where there were discovered the foundations of a large villa, with several tessellated pavements for the different rooms, the crypto-porticus, or enclosed gallery for walking, a sudatory, and a bath. Another road from Regnum passed directly northward into Surrey, which it entered near Haslemere: upon this road, at a distance of 12 miles, was the town of Mida, now Midhurst.

From Ad-decimum the Roman road passed eastward to a place named by Ravennas Anderesio, the modern Amberley, along the high land to Chanctonbury, a circular encampment about 7 miles from Worthing, and about 2 furlongs in circumference; thence to Lancing, where Roman remains of a villa have been discovered; and farther on to a spot near Brighton (Aldrington), called Portus Adurni, a place used for the watch along the coast when the Romans were annoyed by the Saxons. From Portus Adurni a Roman road ran in a northern direction past St. John's Common and through Ardingly into Surrey, and so on to London.

The next town of importance mentioned by Ravennas was Mutuantonis, and this town has been only conjecturally placed at Lewes. The situation is in the direct line of road: it is an easy distance between Bignor and Anderida: it was the most convenient place to pass the Ouse, which must have been at that time an æstuary: the name itself has been conjectured to be compounded of *mutatio* or *mansio*, a mansion; and the British word *anton*, a river. No tesseræ have been found, but many Roman coins have been discovered.

From Mutuantonis the road once more took the hills and proceeded to Anderida. Along the whole line the earthworks at Wolstonbury, Ditchelling, Hollingbury, Whitehawk Hill, and Mount Caburn, clearly mark the route.

The situation of Anderida, as we have already seen, has given rise to much doubt and no little controversy. It was placed by Camden at Newenden in Kent, but that position has been long since abandoned by antiquaries. It was another of the fortresses to keep a look out towards the sea; and the 'Notitia,' or Survey of the Western Empire, informs us that it was garrisoned by a company of the Abulci, with their captain. Newenden never was a seaport, or useful for such a purpose. More modern authorities have been

divided between Pevensey, Eastbourne, and Seaford. In the two last places the remains of Roman villas have been found, and any one of them would be unobjectionable in point of distance; but the evidence of Richard of Cirencester's map, which places the city on the east side of a river, on the meridian line from London, flowing into the British Channel, and the situation of the earthworks on the Downs, rather favour the claim of Seaford.

After the success of the Saxons, Hengist and Horsa, in Kent, others of their countrymen were induced to seek a settlement in Britain; and, in 477, Ella, a chieftain of repute among the old Saxons, accompanied by his sons Cymen, Wincheling, and Cissa, came over to the coast of Sussex, and landed at a place called Cymenes-ore, supposed to be Chichester, where they defeated the enfeebled Britons, and drove them back to the large wood then occupying the Weald. Year by year the invaders advanced their positions eastward towards the district of Hengist (at Eridge, in the parish of Frant, and on the borders of Kent there are traces of one of the Saxon stations, called Saxonbury Hill), till, in the year 485, the British kings and rulers, uniting their forces, collected a formidable army, placed Aurelius Ambrosius at their head, and advanced against Ella and his sons. The two armies met at a place named Mercreadesburne: there was a desperate encounter; both armies were thinned; the victory was doubtful; but Ella was obliged to retire westward, and send to Germany for reinforcements. In the meantime the British held possession of Anderida, which was a fortress of considerable importance. Ella determined to reduce it; and in the year 491, having been joined from Germany, he made his attack. For a time the Britons held out, and much harassed Ella, but ultimately the town was taken; and in revenge for the loss and defeats he had sustained, Ella put every inhabitant to the sword, and razed the town to the ground. He was now fully in possession of the coast, and proclaimed himself king of the South Saxons. On his death, in 514, his district embraced the present counties of Surrey and Sussex.

Of the three sons of Ella, two were never heard of after the battle of Mercreadesburne, and he was succeeded in his kingdom by his third son Cissa. This kingdom was bounded on the north by the river Thames, on the east by the newly-established kingdom of Hengist in Kent, on the south by the sea, and on the west by the Britons, still in possession of Hants and Berks. The cultivated lands were estimated at 7000 hides. Cissa fixed his seat of government at Chichester: he spent much money in the improvement of his capital; and gave to it the name of Cissan-ceaster, of which the modern name is a corruption. The date of his death is uncertain. Of the next occupiers of the South Saxon throne nothing is known: dates and names are alike in confusion, till the reign of Edelwalch, about the year 648, who was attacked and taken prisoner by Wurpher, king of the Mercians, but released and allowed to resume his government on embracing Christianity. He was among the last to embrace the true faith; but on his restoration he appointed Wilfrid, archbishop of York, who had been banished from the kingdom of Northumberland, to teach the Christian doctrines, and granted to him, in 680, the peninsula of Selsey, where the first cathedral was erected, and which was the head of the see, till it was moved to Chichester after the Conquest. In this reign, A.D. 685, Ceadwalla, prince of the royal blood of Wessex, having attacked and ravaged Kent with great ferocity, extended his attacks into Sussex, and sought to usurp the royal authority. He was at first defeated, and fled into the forest of Anderida: ultimately Edelwalch was killed, Ceadwalla established his supremacy over the South Saxon kingdom, and held it till his abdication, A.D. 688. For two centuries it was under the rule of military despots, called 'eorls,' appointed by the kings of Wessex. At length arose Egbert, a politic and brave prince, who was invited by the unanimous vote of the witan from the court of Charlemagne to take possession of the throne, vacant by the death of Brithric. The kingdom of Wessex had been long extending its power over the other Anglo-Saxon kingdoms; but this prince, having defeated the Mercians, A.D. 823, despatched a force into Kent, under his son Ethelwolf, and Alstan, bishop of Sherburn. The ruling prince, Baldred, fled, and Kent passed from the Mercian supremacy.

From this time Sussex, with Surrey and Kent, and probably a part of Essex, was a subordinate portion of the West Saxon empire. It was commonly the appanage of the eldest son or heir-apparent of the king of Wessex; and when he succeeded to the paramount sovereignty, he usually resigned the subordinate crown to his heir. Thus, on the death of Ethelwolf in 857, Ethelbald, his eldest son, ruled over Wessex, and Ethelbert, the youngest, was the governor of Sussex. On the death of Ethelbald in 860, the two crowns were united in the person of his brother Ethelbert, who died in 865. His successor, Ethelred, died in 871, and the illustrious Alfred ascended the throne.

It was during these three reigns that the Danes or Northmen made frequent predatory excursions into these parts: Kent was the principal scene of their attacks, but Sussex did not escape. In the very last year of Ethelred's reign, he and his brother Alfred, having fought the Danes at Reading, gave them fresh battle 'with all the army on Ashdowne,' at a spot in the parish of Horsted, hence still called Dane Hill, and the Danes were overthrown. The pirate Hastings about the same time possessed himself of the town to which he gave his name; and in 893 a Danish fleet of 330 sail, under his command, assembled at Boulogne, and directed its course to the British shore. Two hundred and fifty vessels entered the Rother, as we have already seen in the description of that river. Nor were the attacks confined to the eastern part of Sussex; a body of the Danes who had settled in East Anglia and Northumberland in the year 900, fitted out a fleet, and after being repulsed in Devonshire, landed at Chichester. Here however they were driven back to their ships with considerable loss. Two large barrows at West Stoke, near Chichester, are said to have been erected over the bodies of these marauding sea-kings.

King Alfred made his residence in Sussex, and built several castles for the protection of the coast. Of the few of these castles whose situation is still known, is Burlough castle, in the parish of Arlington and rape of Pevensey, the foundations of which remain upon an eminence to the eastward of the small town of Alfriston, which is named after Alfred.

In the reign of his grandson Athelstane, there was an enumeration of the places in which mints were established; there were two in Lewes, and one each in Chichester and Hastings. When the Northmen renewed their ravages under Ethelred II., A.D. 980-991, Sussex was ravaged in the retreat from London of Colans, king of Norway, and Sweyn, king of Denmark; and again in 1009 and 1013, when Sweyn assumed the government.

In the time of Edward the Confessor, Sussex with Kent was included in the earldom of the famous Godwin, who had become one of the most potent subjects in the kingdom, and exercised within his earldom vice-regal power. After the confiscations of his estates, he harassed this coast with his fleet from Ireland, entering the ports and levying contributions till he procured the reinstatement of himself and his sons in his honours and estates.

On the death of Edward, and the assumption of the throne by Harold, Sussex became the scene of the memorable contest which gave the English crown to the Norman invader. On the 28th of September, 1066, the fleet collected by William reached the bay of Pevensey, and the Normans landed near the mouth of the little river Aston. The decisive battle of Hastings was fought on the 14th of October following, at a spot about nine miles from the place of landing, on a heath then called Epiton or Hetheland, but which thenceforth assumed the name of Battle. [BATTLE.] The details of the battle are well known; the victory was for a long time doubtful, but the fate of the day was decided by a well-executed manœuvre of the Normans, who feigned a retreat, in which they were too eagerly followed by the Saxons; and by the panic which seized the troops of Harold, who had been thrown into disorder on learning the deaths of the king himself and of his two brothers Gurth and Leofwine.

In the reign of William Rufus the civil war was brought into Sussex by the retirement of Odo, bishop of Bayeux, to Pevensey, after his loss of the castles of Tunbridge and Horne. In the troubles of the period of Henry III., on the Downs to the westward of the town of Lewes, at a spot near Plumpton Plain, still called Mount Harry, was fought, on the 14th of May, 1264, the battle of Lewes, between the assembled barons headed by Simon de Montford, earl of Leicester, and the king's troops, commanded by the king himself, assisted by his son Edward and his brother Richard. Prince

Edward was induced to follow the Londoners into the low ground: Montford, perceiving the mistake, attacked the remaining part of the king's forces; and when Prince Edward returned from the pursuit of the Londoners, he found to his dismay that the royal army had been put to the rout, and that his father had precipitately retreated to the priory of St. Pancras. After reinforcing the castle, on which the royal standard still waved, the prince marched with the remainder of his followers to join his father. The immediate result of the battle was the Mise of Lewes, and the ultimate issue the assembling of the first parliament of representatives properly so called. Winchelsea was afterwards attacked by Prince Edward in consequence of its occupation by Simon de Montford, son of the earl; and Montford himself made a fruitless attempt to seize Pevensey.

Jack Cade, whose insurrection in the reign of Henry VI. caused some trouble, extended his march into Sussex [Cade], and is reported to have been killed at Cade Street in Heathfield, where a stone monument has been raised to mark the spot.

In the subsequent reigns till Henry VIII., the whole of the Sussex coast was exposed to the incursions of the French, who landed and burnt Brighton, Seaford, Rye, Winchelsea, and other towns. During the civil wars the castles of Amberley, Arundel, and Bodiam, and the city of Chichester were besieged and taken by the parliamentary forces.

Although the whole of the county was parcelled out by the Conqueror among his followers, and subordinate manors were established in almost every parish, it appears certain that the Normans succeeded no better than their predecessors in winning over the common people. There are nearly two hundred words of pure Saxon origin, little known in other parts of the country, which are in constant use among the natives of Sussex; whilst the blue eyes and light hair of the peasantry indicate their Saxon descent.

Of antient castellated edifices not already noticed or referred to, the most remarkable are Amberley, Bodiam, and Herstmonceux, and the castellated mansions of Eridge, Knepp, and Scotney. The castle of Amberley is situated on the east side of the river Arun, at a distance of four miles from Arundel. The bishops of Chichester had a residence here from the early Roman times, but the present castle was built by Bishop Rede, who was consecrated in 1369, and obtained a licence, in 1 Richard II., to fortify his castle. The ground-plan is nearly a parallelogram. It was built after the French manner introduced by Edward III. after the battle of Poitiers. A square tower rose at each corner: the gateway, the grand feature in the external elevation in castles of this period, is still standing: it was flanked by two projecting round towers, which had machicolations or deeply projecting parapets. The south side is defended by a fosse, over which a bridge leads to the gateway. The present dwelling-house consists of the state apartments, built in the upper court by Bishop Sherburn at the commencement of the sixteenth century: in one still called the queen's room there are some curious paintings, the side pannels exhibiting a series of ten female figures, and the ceiling having the portraits of six warriors carved in wood. The castle was taken and dismantled in 1643, by the parliamentary forces under Waller, and since that period it has not formed the residence of the bishops. Bodiam Castle is of the same æra and built after the same French style as Amberley. It stands at a distance of four miles from Robertsbridge, on the river Rother, at the extreme eastern side of the county. It owes its origin, in 1386, to Sir Edward Dalyngrudge, a valiant knight and captain in the French wars of Edward III., who was married to the heiress of the Wardeuxs, lords of Bodiam. The heiress of the founder carried the castle to the Lewknors, from whom it passed by alienation to the Websters, and then to the Fullers, the present owners, who have taken great pains to prevent its further decay. The site forms a parallelogram or nearly a square, with four round towers at the angles and three square ones between them; the great gateway is flanked by two square towers, and the entrance is defended by a machicolation and portcullis. The fortress is surrounded by a very broad moat, which is supplied with water artificially conducted from the Rother, and assumes the appearance of a small lake. Upon the outside wall, above the gateway, are three escutcheons, after the French manner, bearing the arms of Bodiam, Wardeux, and Dalyngrudge. The interior was fitted up for a baronial residence. In the time of Charles I., Lewknor, the proprietor, was a staunch royalist, and his castle suffered the fate of Amberley, being dismantled by Waller. The castle of Herstmonceux is only of a few years later date. It was built in 1 Henry VI. (1423), by Sir Roger Fiennes, treasurer of the royal household. It stands on the borders of Pevensey Level, a few miles north of that antient castle. It is one of the oldest brick buildings in England, built after the re-introduction of that material, and for four centuries it has stood the brunt of the weather and exposure to the sea vapours without injury. The building is nearly a square, 214 feet from east to west, and 206 feet from north to south. It has an octagon tower at each corner, and another in the centre of the east and west sides. The gateway on the southern side is flanked by lofty octagonal towers 84 feet high, machicolated and embattled; the approach is by a drawbridge over a fosse which surrounds the whole building. It enclosed three courts and a long range of spacious apartments. The Fiennes were afterwards the Lords Dacre of the south. On the failure of male heirs, in the 37th year of the reign of Elizabeth, the house and estates devolved upon Margaret, the wife of Sampson Lennard, and her descendant sold them in 1715 to the Naylors, whence they came to the Rev. Robert Hare, who in 1777 sold the antient tapestry and furniture, pulled down the roof, and wholly dismantled the castle, leaving the walls alone standing. Eridge Castle stands upon a bold eminence in the parish of Frant, on the borders of Kent. From the earliest times the old castle, which was built in the form of a quadrangle, was the residence of the Nevilles, lords Abergavenny, who here entertained Queen Elizabeth for six days. The old residence was forsaken from the time of Charles I., till William, the 42nd baron, at the close of the last century, returned to the antient seat. The castle has been since altered. The antient gallery occupies the entire front of the present building, which is an irregular pile, in the castellated style, embattled and flanked with round towers, but without any regard to architectural unity. Knepp Castle is in the parish of Shipley near Horsham: it is a castellated building in the Gothic style, erected within the last half century by Sir Charles Burrell: of the old castle, at a distance of half a mile, only a single wall is standing: it was long the residence of the family of De Braose, lords of Bramber, and was probably of Norman origin, but of its rise and fall nothing is known. Scotney Castle is on the Kent Ditch, in the parish of Lamberhurst: the stream which divides the two counties runs through the centre of the castle. It was built by a family of this name, about the time of Stephen. At each angle was a round machicolated tower, but the southern only remains. The whole was surrounded by a moat.

Of monastic remains the principal are the mitred abbey of Battle [Battle], the abbeys of Bayham and Robertsbridge, and the priory of St. Pancras at Lewes. The Knights Templars had a preceptory at Sedlescombe, near Battle. Bayham abbey is in the parish of Frant: it was one of the first twenty-seven houses for the Premonstratensian Canons established in England. It was at first situated at Otham, in the parish of Hailsham, but moved to Frant, A.D. 1200. The Sackvilles and De Acquilas were large benefactors; and at the suppression of the minor monasteries, 27 Henry VIII., its income was 152*l.* 9*s.* 4½*d.* Of the abbey buildings there are few remains: the walls of the church, covered with ivy, are in existence, and the ruins of the cloisters, chapter-house, and the gate-house are still seen. The priory of St. Pancras at Lewes ranked in wealth and influence next to the abbey of Battle, and like that abbey it was of the Benedictine order. The house was founded in 1078 by the first Earl de Warren and Gundred his wife, daughter of the Conqueror, who was buried here, and whose tomb, discovered at Isfield, has been replaced in the church near the old priory. It was one of the five principal priories subject to the abbey of Cluni, but it had itself six dependent cells: the priors were constantly summoned to parliament from 1265 to 1364, and had large possessions in Sussex, Surrey, Middlesex, Essex, Lincoln, Hertford, and York. When it was surrendered by Robert Crowham, the prior, on 16th November, 1538, the revenues were valued, according to Dugdale, at 920*l.* 4*s.* 6*d.*, and according to Speed, at 1091*l.* 9*s.* 6*d.* The building itself was nearly demolished by order of Cromwell, the vicar-general: the walls of the refectory alone are in a good state of preservation, and there are a few walls of the other parts. The high altar cannot be traced. The abbey of Robertsbridge, situated on the river Rother, in the parish of Salehurst and rape of Hastings, was the third of the religious

houses in Sussex, the revenues of which exceeded 200*l.* It was founded in 1176, by Alured St. Martin, for monks of the Cistercian order; and at the time of its surrender by Thomas Taylor, on 6th April, 1539, the gross revenue of the house amounted to 272*l.* 9*s.* 8*d.*, and the clear income to 248*l.* 10*s.* 6*d.* The work of destruction has been so perfect, that the crypt with a spider-arched roof, three lofty arches of the chapel in the south wall, an arched entrance at the west end, and the eastern gable, overgrown with ivy, are all that can be seen, though the foundation can be traced for some distance. The ruins have been converted into a farm-house.

The religious edifices in the county are generally mean and small. Those which are exceptions and most worthy of note are the cathedral [CHICHESTER], the churches of Arundel [ARUNDEL], of Rye [RYE], of New Shoreham [NEW SHOREHAM] and of Broadwater. The latter is a cruciform building, with a low square tower in the centre and a round corner turret. The chancel has a groined roof. The arch under the tower next the nave is pointed and enriched with Saxon zigzag ornaments; the arch entering the chancel is semicircular and in the richest style of Norman ornament. The capitals of the lofty columns are surmounted by palm-branches, an ornament introduced by the Crusaders.

(*Ordnance Map*; Mantell's *Geology of the South-East of England*; Dallaway's *Western Sussex*; Horsfield's *History of Sussex and Lewes*; Watson's *History of the Earls of Warren and Surrey*; Tierney's *History of Arundel*; *Excursions in Sussex*; Lee's *History of Lewes*; Stockdale's *Sketch of Hastings, &c.*; Estancelin's *Histoire des Comtes D'Eu*; Hay's *History of Chichester*; Sharon Turner's *History of the Anglo-Saxons*; Cooper's *Glossary of Sussex Provincialisms*; Rickman's *Gothic Architecture*; Burrell *MSS.*; Hayley *MSS.*; *Parliamentary Reports.*)

STATISTICS.

Population.—The inhabitants of Sussex are principally engaged in agriculture; but the large watering places along the coast afford employment for artisans. Out of 67,077 males, twenty years of age and upwards, living at the enumeration of 1831, only 109 were returned as employed in manufacture or in making manufacturing machinery. Of these, 40 were employed in the town of Brighthelmstone, 13 at Eastbourne, and 5 at the powder-mills at Battle. The proportion of persons employed in agriculture has been diminishing, the actual proportion in three periods being:—

	1811.	1821.	1831.
Families employed in agriculture	54·92	50·31	42·58
Families employed in trade and handicraft	29·86	35·50	33·18
Other classes	15·22	14·19	24·24
	100·	100·	100·

In 1831 Sussex stood twelfth among the agricultural counties in the number of families employed in agriculture.

The population of Sussex at each of the five enumerations made during the present century was:—

	Males.	Females.	Total.	Increase per Cent.
1801	78,797	80,514	159,311	
1811	94,188	95,895	190,083	19·
1821	116,705	116,314	233,019	22·
1831	135,333	137,007	272,340	17·
184.	147,572	152,198	299,770	10·

showing an increase between the first and last periods of 140,459, or 88 per cent., being more than the average increase in the whole of England.

The following table gives a summary of the population of every rape in the county, as found at the census of 1831:—

RAPES, BOROUGHS, &c.	HOUSES. Inhabited.	Families.	Building.	Uninhabited.	OCCUPATIONS. Families chiefly employed in agriculture.	Families chiefly employed in trade, manufactures, and handicraft.	All other Families not comprised in the two preceding classes.	PERSONS. Males.	Females.	Total of persons.	Males twenty years of age.
Arundel	5,207	6,033	41	167	3,211	1,597	1,225	15,800	15,264	31,064	7,808
Bramber	5,073	5,717	54	238	2,803	1,768	1,146	15,277	14,836	30,113	7,568
Chichester	5,161	6,073	31	203	3,376	1,313	1,384	15,631	15,028	30,659	7,855
Hastings	8,046	9,556	72	221	4,411	2,608	2,537	24,905	25,304	50,209	12,050
Lewes	3,656	4,457	82	121	2,608	959	890	12,559	11,740	24,299	6,199
Pevensey	7,566	8,967	40	191	5,705	2,110	1,152	24,997	23,503	48,500	12,009
Chichester (City)	1,514	1,701	16	109	141	1,076	484	3,838	4,432	8,270	1,935
Lewes (Borough)	1,454	1,604	4	62	89	912	603	4,110	4,482	8,592	2,010
Brighthelmstone (Town)	7,798	8,608	280	547	106	5,146	3,356	18,216	22,418	40,634	9,643
Totals	45,505	52,716	620	1,859	22,450	17.489	12,777	135,333	137,007	272,340	67,077

By the census of 1841 the number of houses inhabited was 54,066; uninhabited 3674; building, 253.

County Expenses, Crime, &c.—The amount raised for the relief of the poor and other county purposes in each of the four periods ending March, 1803, 1813, 1821, 1833, and 1840, near the period of each census, was:—

1803	206,225*l.*, being	1*l.*	5*s.*	10*d.*	for each inhabitant.
1813	350,564 „	1	17	10	„	„
1821	276,450 „	1	3	8	„	„
1833	319,547 „	1	3	5	„	„
1840	167,141 „	0	11	2	„	„

These averages are all above the general averages of England and Wales.

The amount expended in actual relief in each of the years ending 25th March, 1834, 1839, and 1840, was as under:—

	£		*s.*	*d.*	
1834	246,626	or	18	1	for each inhabitant.
1839	142,410	..	10	5	„
1840	144,128	..	10	7	„

Being a decrease of 7*s.* 6*d.* a head in 1840 as compared with 1834. There was also a decrease of 76 per cent. in the law charges; and 71 per cent. in money expended for other purposes. In 1834 Sussex was the most pauperised county in England, the rate of money per head of the population expended in relief being higher than in any other county: and it is now exceeded by Wiltshire alone, where the rate of expenditure is 11*s.* 1*d.* per head.

The sums expended in each of the years 1834, 1839, and 1840, were divided as under:—

	1834. £	1839. £	1840. £	Dec. p. cent. in 1840 compared with 1834.
Expended for relief of poor.	246,626	142,410	144,128	41·
Suits at law, removals, &c.	7,873	1,269	1,873	76·
For all other purposes (except county-rate and registration)	30,937	13,387	8,932	71·
	£ 285,436	157,066	154,933	46·
Payments towards county-rate, 1840			10,561	
Payments under registration and parochial assessment act			1,647	
Total parochial rates, &c. expended in 1840			£167,141	

During the year ending 25th March, 1841, the poor-law

commissioners authorised the sum of 1673*l.* to be raised for the purposes of emigration, which was applied towards the emigration of 95 adult persons above 14 years of age, 29 children between 7 and 14 years of age, and 37 children under the age of 7 years, most of whom went to Sydney.

The whole length of the highways in Sussex is 2368 miles, the expenditure on which in 1839 was 25,053*l.*, or 10*l.* 11*s.* per mile. There are 678 miles, 35 furlongs, and 4 yards of turnpike-roads in the county, under the management of 53 trusts, of which 22 do not exceed 10 miles in length, a like number do not exceed 20 miles, five do not exceed 25 miles, and four do exceed 25 miles. The number of toll gates and side-bars in 1838 was 243. In 36 of the trusts, the roads in 1838 were in good repair, in 12 they were in tolerable repair, in 4 they were in bad repair, and a portion of one was under indictment. In 43 of the trusts the roads were wholly repaired by the trustees, in 9 partly by the trustees and partly by the parishes; and one, the Horsham and Steyning road, is repaired by the trustees, except a small part near the bridge over the river Adur, between Bramber and Beeding, which, together with the bridge, is repaired by Magdalen College, Oxford. In 49 of the trusts the pecuniary value of the securities has not been diminished, in two it has, in two trusts there is no mortgage debt, but it appears that a great number of trusts will be affected by the Brighton railway. The total amount of mortgage and debts on bond on 31st December, 1838, was 282,593*l.* 17*s.*, of which 8416*l.* 12*s.* 8*d.* consisted of unpaid interest converted into principal; and the total amount of interest paid was, in 1832, 7656*l.* 0*s.* 6*d.*; in 1833, 8794*l.* 1*s.* 9*d.*; in 1834, 8241*l.* 13*s.* 7*d.*; in 1835, 8871*l.* 8*s.* 3*d.*; in 1836, 8586*l.* 0*s.* 5*d.*; in 1837, 9039*l.* 9*s.* 7*d.*; in 1838, 9119*l.* 8*s.* 9*d.*; and in 1839, 8860*l.* 3*s.* 9*d.*

The annual income arising from the tolls and parish compositions in lieu of statute duty was, in 1839, 49,481*l.*, and the annual expenditure in the same year was 46,255*l.* as follows:—

	£	*s.*	*d.*
Manual labour . . .	9904	16	11
Team-labour and carriage of materials	8996	9	2
Materials for surface repairs .	3987	14	11
Land purchased . . .	42	0	0
Damage done in obtaining materials	497	8	11
Tradesmen's bills, law charges, &c.	1813	8	6
Salaries of treasurer, clerk, and surveyors	1385	1	5
Improvements . . .	5887	0	4
Interest of debt . . .	8860	3	9
Towards redemption of the debt .	1542	10	0
Incidental expenses . .	634	4	5
Law charges . . .	1575	10	1
Estimated value of statute-duty performed	129	0	0

The county expenditure for the year ending October, 1841, exclusive of that made for the relief of the poor, was, in East Sussex, 14,937*l.* 13*s.* 10*d.*; and in West Sussex, 4,347*l.* 5*s.* 7*d.*; and was disbursed as follows:—

	East Sussex. £	*s.*	*d.*	West Sussex. £	*s.*	*d.*
Bridges, building, repairs, &c.	301	17	8	133	18	7
Gaols, houses of correction, and maintaining prisoners .	4,626	11	2	2,199	16	5
Shire-halls and courts of justice, building, repairing, &c. .	337	13	9			
Lunatic asylums . . .	113	13	6			
Prosecutions . . .	3,176	12	11	779	14	8
Clerk of the peace . . .	877	16	1	500	0	0
Conveyance of prisoners before trial	1,034	18	0	239	4	1
Constables, high and special, and police, included in a police rate . . .	3,006	11	2			
Coroners	546	7	9	179	12	0
Treasurer				40	0	0
Militia payments . . .	18	2	1			
Weights and measures . .	206	3	4	106	3	2
Miscellaneous . . .	531	6	5	168	16	8
	£14,937	13	10	4,347	5	7

The number of persons charged with criminal offences within the county, in each of the three septennial periods ending with 1819, 1826, and 1833, was 922, 1841, and 2348; being an average of 132 annually in the first period, of 263 in the second, and of 335 in the third. The average number for the last 7 years, ending 1840, has been 3141, or a yearly average of 449.

Of the number committed for trial in 1840 there were—

	Males.	Females.	Total.
For offences against the person .	31	3	34
For offences against property with violence	37	0	37
For offences against property without violence	373	66	439
For malicious offences against property	4	0	4
For forgery and offences against the currency	11	5	16
For other offences not included in the above	12	1	13
Total	468	75	543

The number of persons against whom bills were not found by the grand jury and who were acquitted on trial was 157: of the remaining 386 who were convicted, 239 were for simple larceny; 39 larceny by servants; 18 housebreaking; and 13 for common assaults. There was one person sentenced to death who had his sentence commuted to transportation for life. Of the remaining convicts the sentences were—

Transportation for life . . .	15	
„ 15 years . . .	2	
„ 14 years . . .	13	
„ 10 years . . .	15	
„ 7 years . . .	34	
	—	79
Imprisonment for 2 years and above 1 . .	4	
„ 1 year and above 6 months	26	
„ 6 months and under	269	
	—	299
Whipped, tried, and discharged . . .		7
		385

The ages of the persons accused were—

	Males.	Females.
Aged 12 years and under .	16	..
„ 16 years and above 12 .	48	9
„ 21 years and above 16 .	106	21
„ 30 years and above 21 .	149	23
„ 40 years and above 30 .	79	13
„ 50 years and above 40 .	46	6
„ 60 years and above 50 .	5	3
Age above 60 years . . .	12	..
Age could not be ascertained .	3	..

Their state of instruction was as follows:—

	Males.	Females.
Could neither read nor write .	148	25
Read or write, and write imperfect	306	47
Read and write well . .	11	2
Superior instruction . .	..	..
Instruction could not be ascertained	3	1

The number of electors qualified to vote for the county members in Sussex at the registration of 1841-42 was, for the eastern division 5994 and for the western division 3678; being about 1 in 15 of the whole male population in that year. The numbers registered in 1839-40 were thus divided—

	East Sussex.	West Sussex.
Freeholders . . .	3482	2452
Copyholders . . .	681	357
Leaseholders . . .	59	154
Occupying tenants . .	977	504
Trustees . . .	29	12
Holders of offices . .	40	78
Registered for joint qualifications	48	29
Total registered in 1839-40	5316	3122

or an increase in East Sussex of 492 and in West Sussex of 464, over the numbers registered for the years 1835-36.

The number of savings-banks in Sussex is 13. The number of depositors and the amount of their deposits as they stood on 20th of November in each of the last three years were as follows:—

	1838.		1839.		1840.	
	Depositors.	Deposits.	Depositors.	Deposits.	Depositors.	Deposits.
Not exceeding £20	7,231	£15,510	7,067	£46,958	7,780	£49,611
,, 50	3,026	94,146	2,967	99,900	3,176	97,809
,, 100	1,293	87,715	1,281	87,765	1,342	92,938
,, 150	376	44,922	400	47,548	435	51,553
,, 200	251	42,296	257	43,117	249	41,836
Above . . 200	32	8,296	35	8,351	30	7,531
	12,202	322,945	12,067	324,729	13,021	341,123
Charitable Institutions	157	8,262	152	9,240	163	9,786
Friendly Societies .	70	8,944	79	9,303	79	10,036
Total . .	12,420	340,152	12,298	343,271	13,263	360,950

Education.—The following summary is taken from the Returns made to the House of Commons, and ordered to be printed 20th March, 1833:—

	Schools.	Scholars.	Total.
I. Infant-schools . .	53		
Number of infants at such schools:—			
Males . .		796	
Females . .		771	
Sex not specified .		238	
			1,805
II. Daily-schools . . .	962		
Number of children at such schools:—			
Males . .		11,418	
Females . .		12,464	
Sex not specified .		4,190	
			31,072
Schools . .	1,015		
Total of children under daily instruction . . .			32,877
III. Sunday-schools . .	287		
Number of children at such schools; ages from 4 to 15 years:—			
Males . .		9,496	
Females . .		8,605	
Sex not specified .		3,333	
			21,434

IV. *Maintenance of Schools.*

Description of Schools.	By endowment.		By subscription.		By payments from scholars.		Subscrip. and payment from scholars.	
	Schls	Scholars.	Schls.	Scholars	Schls.	Scholars.	Schls.	Scholars.
Infant Schools	2	32	4	432	39	749	8	692
Daily Schools	65	2236	76	4,997	733	16,710	88	7,129
Sunday Schools	15	1068	230	16,953	..	..	42	3,413
Total...	82	3336	310	22,382	772	17,459	138	11,134

V. Religious Distinction:—

Schools established by Dissenters:—

	Schools.	Scholars.	Total.
Infant-schools . .	2	166	
Daily-schools . .	18	1,451	
			1,617
Sunday-schools . .	68		7,044

VI. Schools established since 1818, or, properly speaking, the increase of schools since 1818:—

		Scholars.
Infant and other daily schools	453, containing	17,364
Sunday-schools . .	197 .	15,840

Lending libraries of books are attached to 51 schools in the county of Sussex.

SUTHERLAND is an extensive, compact, and well-defined shire or county in the northern division of Scotland. This county stretches from the German Ocean, along which it has a sea-coast of about 24 miles from Embo to the Ord of Caithness, across the whole breadth of the island to the Atlantic Ocean and the North Sea; having along the Atlantic, or from Inverkirkaig Bay to Cape Wrath, a sea-coast of 62 miles in length (without including the bays and indentations), and along the North Sea from Cape Wrath eastward to Drum Hallastain, a similar sea-coast of 66 miles. On the south Sutherland is divided from the intermingled counties of Ross and Cromarty by the river Portnaculter, or the æstuary of the Oykill (now generally called the Dornoch Frith), which opens into the Moray Frith eastward of the formidable bar of the Gizzen Briggs, by the river Oykill, by an irregular short conventional boundary among barren uplands, and thence by two fresh-water lochs, and the river and bay of Kirkaig, which opens to the Atlantic. On the north-east Sutherland is divided from Caithness, the most northern county of Scotland, by a lofty and unbroken range of hills which extends from the headland of the Ord of Caithness to that of Drum Hallastain.

The well-defined district comprehended within these boundaries contains an area of about 1865 square miles of land and 38 square miles of water, or 1,193,940 acres of land and 24,230 acres of water. The length of this county in straight lines varies from 60 to 42 miles, and the breadth from 54 to 42 miles. It lies between ––° 55′ and 58° 37′ N. lat., and 3° 43′ and 5° 23′ 30″ W. long.; the mountain Ben Klibreck, which is nearly in the centre of the county, being in 58° 14′ 6″ N. lat. and in 4° 24′ 32″ W. long.

There are no islands along the east coast of Sutherland, but there is a number of small islands along the west and north coasts, of which four are inhabited. Oldany, Calva, and the island of Handa, are the largest of these islands on the west coast. Handa is remarkable for the altitude and wild grandeur of its cliffs, in which innumerable sea-fowl hatch their young. Along the north coast, the lofty peaks of the Stack and Skerries islands, belonging to this county, are conspicuous in clear weather at a distance of some miles from the coast. Island Hoan, the Rabbit Islands, Island Roan, and Island Neave, or Holy Island, are situate close to the coast, and form, in some instances, natural breakwaters, and afford protection for shipping.

The name of Sutherland came from the Northmen, who frequently infested the Scottish shores in and before the twelfth century, and made early settlements along the coasts of Caithness. The present county of Sutherland was, with reference to the position of Caithness and Orkney, the *southern land* of these Norwegian and Danish settlers, and hence the origin of the name of Sutherland, which was applied to a large and important territory, known to the Celtic inhabitants of the Highlands, and still exclusively called, in the Gaelic language, Cattey.

Sutherland is a mountainous and pastoral district. The whole of the interior of the county consists of a succession of mountains and ranges of hills, and some extensive moors, broken and separated by several straths and mountain glens, diverging from the principal valleys, which open towards the sea-coasts. Among these mountain-ranges, one of great altitude, which contains several mountains among the highest in Great Britain, separates the west and north coasts of the county from its southern shore and valleys, and runs in a line nearly parallel with the trending of the indented shores of the Atlantic and North seas. The detached and conical mountain of Suilven, in Assynt, forms the characteristic and picturesque southern pillar of this lofty range; while Ben More of Assynt, which attains an elevation of 3431 feet, Ben Leod, Ben Hee, Meal Ryne, Stack, Arkle, Fionaven, and Ben Spinnue, mark with their towering summits the prolongation of this range to within a few miles of the North Sea. The coast near this point trends almost due east from the bold headland of Cape Wrath; and parallel to it, the continuation of the same elevated ridge is traced in the prominent and equally elevated mountains of Ben Hope, Ben Loyal, Ben Stomino, and the two Ben Griams, to within a short distance of the county of Caithness. The alpine character of this extensive range is also preserved in the magnitude of many lakes at the base of the mountains, in the depth and abruptness of the openings and passes, in the expansion of widely-spread mountain sides and formidable mosses and bogs, and in a variety of romantic valleys and rugged glens and hollows. The western and northern districts of the county, thus separated by the mountains of the interior from the southern and eastern parts, are unlike them in appearance and character. Thus, the two parishes of Assynt and Eddrachilles, along the west coast, are remarkable, even in comparison with the wildest districts of the Highlands of Scotland, for the general ruggedness and inequalities of the surface, and for the vast number of rocky eminences and of second-rate lakes which characterise the district. Along the north coast the same description of country continues, but in a more modified form, and softened by an open track of arable land in the parish of Durness,—by the picturesque beauty of Tongue, and its improved domains and old trees,—by the extensive and beautiful valley of Strathnaver, and the more tame, but fertile Strath of Halladale. The sea-coasts of these two districts also present headlands, promontories, and numerous cliffs of the boldest description. In contrast to these striking and distinguishing features of the west and north divisions of the county, the eastern and southern parishes are marked by several extensive and pleasant valleys, by less elevated

hills, by rich pasturage, and by valuable tracks of arable land, in a high state of cultivation, in the parishes of Creich, Dornoch, Golspie, Clyne, and Loth; and, with the exception of the headland of the Ord of Caithness, the sea-coast along the eastern shore is flat and sandy.

The height of some of the Sutherland mountains has been accurately determined: the following list contains, besides the ascertained elevations, the computed height of others, which is believed to be tolerably accurate:—

Ben More of Assynt, ascertained to be		3431 feet.
Ben Klibreck,	..	3164
Ben Hope,	..	3061
Fionaven,	..	3015
Ben Hee,	..	2858
Ben Spinnue,	..	2566
Ben Armin,	..	2306
Ben Griam-more,	..	1935
Ben Uarie,	..	1923
Ben Veallich,	..	1838
Ben Horn,	..	1712
Ben Smorale,	..	1667
Ben Lundie,	..	1467
Ben Hutie,	..	1345
Ben Bhraggie,	..	1282
Suilven, computed to be		2700
Ben Loyal,	..	2500
Canisp,	..	2500
Arcle,	..	2500
Stack,	..	2400
Queenag,	..	2200
Ben Leod,	..	2200
Brebag,	..	2000
Meal Rynie,	..	2000
Meal Horn,	..	2000
Fashven,	..	2000
Knock ari-na-Coolanin, computed to be		2000
Ben Stonmo,	..	1800
Glasven, Assynt,	..	1800
Ben Durach,	..	1800
Cranstackie,	..	1800
Ben Garve, Assynt,	..	1700
Meal-na kra,	..	1600
Craig-na-chic,	..	.600
Bendergmore,	..	1500
Ben Griam-beg,	..	1500
Ben Rev,	..	1400
Ben Duan,	..	1400
Kolliebеn,	..	1400

This county is abundantly watered by many rivers and their tributary streams, partly flowing from extensive inland lakes, and partly formed by the junction of innumerable mountain-streams. All these rivers have their source, supplies, and auxiliary streams within the county of Sutherland, with the single exception of the subordinate streams of the Eanack and Carron, which flow through the county of Ross before joining the æstuary of the Oykill. The salmon-fishings of the larger rivers are very valuable; but with the exception of the intricate and narrow channel of the Frith of Dornoch and the short æstuary of the Fleet, none of them are sufficiently large to be navigable. The Oykill is the chief river of the county: its source is in Loch Aish, a picturesque lake to the east of Ben More of Assynt. The Oykill forms the boundary between the two counties of Ross and Sutherland, and, after being augmented by the Eanack, Cassley, Shin, and Carron, expands into an æstuary, the antient Portnaculter, but now generally called, at its mouth between Tarbetness and Embo, the Dornoch Frith, and, above the town of Tain, the Kyle of Sutherland. The Kyle, at a narrow point at the village of Bonar, is crossed by a handsome bridge of three arches, one an iron arch of 150 feet span, and the other two stone arches of 50 and 60 feet respectively, erected at an expense of near 14,000*l.* The river Shin, which flows from a lake of the same name, has a course of six miles before it joins the Oykill, and is the most important salmon river in the county: the yearly average take of salmon and grilse at this station is computed to exceed 122,000 lbs. weight. The other important rivers in the county are the Cassley, which joins the Oykill; the Fleet, which opens into a small æstuary, formerly known as Unes, and now as the Little Ferry; and the Brora and Helmsdale, both of which enter the Moray Frith. The river Halladale, the Strathy, the Naver, the Torrisdale, the Hope, and Dionard all flow into the North Sea; and the Inchard, Laxford, Inver, and Kirkaig enter the Atlantic on the west coast.

The interior and western districts of Sutherland are remarkable for the great number of fresh-water lakes, which in general lie at the base of the higher mountains, or occupy the hollow spaces in the rocks and mosses of the rocky western coast. Loch Shin, with the almost connected smaller lake called Loch Griam, is 18 miles in a straight line from its eastern to its western extremity, and forms one, and the largest, of a singular chain of lakes, which, with the exception of a few miles between each of them, extends from near the head of the Dornoch Frith on the east coast to Loch Laxford, a salt-water loch of the Atlantic on the west coast. The other lakes forming this chain are lochs Merkland, More or Rynie, and Stack, all large and deep, and situated amidst very romantic scenery. Loch Assynt, another sheet of water, surrounded by some of the highest and most picturesque mountains of the county, is the largest lake along the west coast; Loch Hope, Loch Maddie, Loch Naver, Loch Loyal, Loch Carr, and Loch Vealloch are conspicuous on the north coast and in the centre of the county; and Loch Badanloch, Loch-na-clar, Loch-nakuen, Loch Truderscaig, Loch-ari-cliny, and Loch-in-ruar are situated in the inland and eastern parish of Kildonan. Loch Brora and several smaller lakes are situated among the high grounds along the east coast.

The rocks of the interior of Sutherland and a considerable portion of the west coast are gneiss. Detached districts, chiefly in the parish of Rogart and on the confines of Caithness, exhibit great masses of granite, and the high hills of Loth are composed of porphyritic granite of different colours, yellow, reddish-brown, and grey. Sienite abounds on the north shore of Loch Shin, and also large rocks of granular marble. The parish of Assynt also contains extensive masses of white marble, and many of the high hills in that district are of quartz. Limestone is the prevailing rock in the parish of Durness, with the exception of the headland of the Parph, which terminates in Cape Wrath, and in which quartz, red-sandstone, and conglomerate prevail. The headland of Stoir in Assynt is also formed of high cliffs of red-sandstone, with pebbles imbedded in it. Along the east coast of the county the high hills of Golspie and its neighbourhood are formed of old conglomerate; and the low parts of the east coast between Golspie and Helmsdale are composed of oolite sandstone of a beautifully white and fine-grained variety, sandstone-flag, limestone, and coal. Veins are very seldom found in the transition or secondary strata of Sutherland: but veins of quartz sometimes occur in the granite and micaceous schist; and veins of calcareous spar and of tremolite are found in the marble near Loch Shin; and in the rocks of Kildonan large veins of a rude kind of porphyry are formed.

The cultivated soils along the east coast are principally formed from the decomposition of sandstone rock, which often approaches in its nature to shale; and the soils of the straths opening along the east coast seem to be derived from the decomposition of transition sandstone and breccias.

Sutherland, in common with the north of Scotland, has a variable climate, but along the sheltered east coast it is very mild and salubrious. The high parts of the interior and the west coast are subject to continued and heavy falls of rain, the injurious effects of which to the human constitution appear however to be counteracted by the purity and invigorating quality of the mountain and sea breezes, and the antiseptic properties of the mosses on which the superabundant rain accumulates. The valleys are in general well sheltered and cheerful: but in July and August they are often oppressively warm and sultry; and this heat along the west and north coasts fills the air with gnats, which in calm weather harass men and cattle so much as to render outdoor work during the heat of the day almost intolerable.

The arable land of Sutherland lies principally close to and along the east coast; and there the most improved system of Scottish husbandry is carefully acted upon. The Dunrobin breed of Highland cattle belong to this county, and are well known, and eagerly purchased in the southern counties. Sheep of the pure Cheviot breed are by far the most important stock, and the staple produce of the Sutherland high grounds. The interior uplands and some of the

valleys are divided into extensive sheep-farms, which are well stocked; but which in summer and autumn, and during a portion of the spring season, could support a much greater number of sheep, provided a supply of winter food could be depended upon. The present permanent sheep stock of the county is computed at 170,000 sheep, and these yield about 450,000 lbs. of wool, which is generally purchased by the English manufacturers. On the arable farms the grain raised is limited to barley, oats, and occasionally wheat and rye: the barley of Sutherland is equal in quality to any raised in Scotland, and weighs on an average from 55 to 56 lbs. per bushel; large parcels have been sold of late years that weighed 57½ lbs. Turnips are extensively raised, and chiefly consumed on the field by sheep during the winter season; and potatoes of excellent quality are cultivated for home consumption, and form the chief article of food for the great bulk of the population. The proper rotation of cropping is well understood, and strictly attended to on all large farms, which are laboured under the five-years shift of husbandry, having annually one-fifth part of the land in fallow, turnips, potatoes, or other green crop; one-fifth part in grass one year old; one-fifth part in grass two years old, and not more than two-fifth parts in corn crop.

In most of the valleys, natural woods of birch, alder, and occasionally oak, adorn the steep sides and water edges; but the extensive forests of Scottish pines that, at a remote period, covered the greater part of the interior of this county have long ago totally disappeared. The extent of planted wood of full growth is not great; but, at the date of writing this article, very extensive plantations of fir, larch, and other forest trees have either been completed or are in progress on the estates of the duke and earl of Sutherland, which, in the course of twenty or thirty years, will highly ornament the country, and cover comparatively barren moorland with valuable timber.

Several parts of this county have been celebrated for centuries as deer forests; and there the red deer are still found in great numbers, and of a size and weight not equalled in any other part of Scotland. Roe deer are also common in the woods; and game of all kinds, being protected, is abundant in all parts of the county. The county has no manufactures; but that valuable and national branch of industry, the fisheries, is prosecuted with vigour and success, and promises to continue to add most materially to the prosperity and wealth of the district. The west and north coasts are singularly well adapted for the establishment of cod and ling fisheries on a large scale; and the numerous salt-water lochs and bays in these quarters are annually, but at irregular periods, frequented by shoals of the rich and valuable description of herrings common in similar places along the west coast of Scotland. The east coast of the county, again, is annually visited, for nearly two months after the middle of July, by those immense shoals of herrings that regularly pass along the eastern shores of Caithness and the opposite coast of the Moray Frith; and which, by the regularity of their appearance and course, have occasioned the permanent establishment of fishing and curing villages and stations at many otherwise inhospitable parts of the sea-coast. Thus the village of Helmsdale, in this county, has arisen, from a hamlet of three or four cottages, within the last thirty years, to a bustling, industrious, and prosperous village, with all the means of future increase and success, from the active prosecution of the herring fishery; and here, of late years, no less than 40,000 barrels of herrings, on an average, have been cured annually within the Helmsdale district, of which nearly 25,000 barrels were annually exported. Vast numbers of lobsters are taken along the coasts of Sutherland, and sent to the London market; and fishing-smacks from the Thames regularly frequent the fishing-banks off the northern and west coasts, and convey to London cod of the best quality.

Formed roads were only commenced in this county in the year 1811; and since that period the whole circuit of the county of Sutherland has been provided with roads of the best construction, and numerous bridges, embankments, and mounds necessary to connect and complete them. Cross-roads lead through the interior parts, and across the county from one extremity to the other, and the whole are kept in the best state of repair, without levying a single toll within the county from the public; the original construction was effected by the munificence of the late duke and duchess of Sutherland, and the repair of the roads is defrayed by an equitable assessment borne equally by landlord and tenant.

Dornoch is the only burgh within the county, and joins with Wick, Kirkwall, Tain, Cromarty, and Dingwall in returning a member to parliament. It was antiently the seat of the bishops of Caithness, part of whose palace is still entire, and used for county purposes; and the old cathedral of the diocese, which stood here, after being burnt during the desperate feuds of the sixteenth century, was partially repaired at different subsequent periods, and was ultimately rebuilt in its present handsome and chaste form within the last few years, at the sole expense of the late duchess-countess of Sutherland. This cathedral contains the remains of the Sutherland family from the thirteenth century, and here were deposited, amidst the sincere lamentations of thousands of their tenantry, the bodies of the late duke of Sutherland in the year 1833, and of the late duchess-countess of Sutherland in 1839. Dornoch derived its origin from being the seat of the bishopric: being without trade or manufactures, it is a small town, and important only as being the county town. The larger villages of the county are Helmsdale, Brora, Golspie, and Bonar; but Loch Inver, Scowrie, Kirkiboll, Port-Skerra, Port-Gower, Spinningdale, Clashmore, and Embo are called villages, and form small rural or fishing hamlets.

The population of this county, by the census of 1841, is stated at 24,666; which shows a decrease of 852 from the population of 1831. This arises from the absence of manufactures within the county, and the emigration of some of the rural population. Sutherland returns one member to parliament; and of the thirteen parishes within the county the duke and earl of Sutherland is proprietor of the whole lands in ten of these parishes, and that part of the parish of Reay which lies in Sutherland, and also of estates and lands in the remaining three parishes. The antiquities of Sutherland consist principally of rude structures of ages so remote as to be lost even to tradition, but which, if closely studied, might be interesting in relation to the period of the Pictish kingdom in Scotland. Upright stones, tumuli, stone battle-axes, and old battle-fields have reference to the invasions of the Danes; and the foundations and ruins of old towers and strongholds attest the existence of feudal usages.

The history of Sutherland is in many respects interesting and instructive. At the earliest period of Scottish history, the thanes of Sutherland, then the only title of nobility in Scotland, figure conspicuously in the transactions of the kingdom; and in the thirteenth century their descendants appear as earls of Sutherland, and the succession of this antient family has continued in unbroken direct descent down to the present time, the late duchess-countess of Sutherland having, by a solemn decision of the House of Lords in 1771, when she was an infant, been adjudged to have 'right to the title, honour, and dignity of the earldom of Sutherland, as heir of the body of William, who was earl of Sutherland in 1275.' The present duke of Sutherland, eldest son of the late duke and duchess-countess, is now the twentieth earl of Sutherland, in direct lineal descent from Earl William of 1275, and is consequently premier earl of Scotland.

(*Communication from Scotland.*)

SUTLEGE, or SUTLEDGE. [HINDUSTAN, p. 219.]

SUTTEE (*Sati*, from the Sanscrit *sat*, good), properly means a chaste and virtuous wife, and in ordinary use is applied to one who burns herself on her husband's funeral pile. The term has subsequently been employed by Europeans to denote the act of self-immolation as practised by Hindu widows. When this practice was first introduced cannot be determined with any degree of certainty: it is described by the Greek writers of the age of Alexander, and by Mohammedan and Christian travellers of the sixteenth and seventeenth centuries. The Hindus have been subdued by various conquerors; and a foreign and bigoted race of people has been incorporated among them: but this practice by its continuance affords a sufficient proof that it was always considered as an act of religious duty, based upon a strong faith in the immortality of the soul, and not, as has been asserted by some writers, a consequence of the degradation to which women in India are condemned after the death of their husbands. Diodorus (xix. 33) gives an instance of a Suttee which occurred in the army of Eumenes upwards of 300 years before the Christian æra; and he ascribes the zeal for this kind of self-sacrifice, in most instances, to the infamy which attached to those widows

who refused to conform to the custom. This is also the view taken by our missionaries; but as Elphinstone ('History of India,' i. 358) justly observes, if the motive were one of so general an influence, the practice would scarcely be so rare. It is not improbable that the doctrine of transmigration generally held throughout India may have had some influence in the establishment of the custom of the Suttee. A widow by burning herself with the corpse of her husband was to be immediately released from further migration, and enter at once on the enjoyments of Heaven, to which by this act she would also entitle the deceased. Again, perhaps the hope of meeting the departed in the Swarga (Sahagamana) would be sufficient to induce a faithful wife to sacrifice herself. But though this barbarous custom may appear to be antient, it is in fact comparatively modern; for in no authentic antient writings of India, whether legal or religious, do we find any mention of it. It is certain that Manu, in his directions to Hindu widows (book v.), does not even allude to it. This circumstance is urged as a proof of the high antiquity of the code known by the name of this legislator. This, as well as the fact that those passages which have been brought forward as supporting self-immolation are either spurious or perverted from their meaning, may lead us to suppose that the Suttee arose at the same time as the prevailing worship of Kalî, of which no mention is made in the sacred books. And indeed, according to the minutes laid before the House of Commons in 1830, there were in 1825 more Suttees in the district of Calcutta, where the worship of Bhâvanî or Kalî is most common, than in any other part of India. It cannot be denied however that some good Indian authorities recommend the practice, but by no means command it. According to a summary of the law and custom of Hindu castes, compiled by Arthur Steele, and printed at Bombay by order of the governor in 1827, the most virtuous mode of becoming a Suttee is to die of affliction and grief on the husband's death. The usual practice indeed is self-immolation on the husband's funeral pile; but the many cases under which a widow is excused becoming a Suttee, strongly support the supposition that none of the Hindu law-books imperatively command it. The exceptions are as follows: 1, if pregnant; 2, if under puberty; 3, if she has a sucking child; and 4, if the sacrifice is merely made with the view of escaping distress, &c. Diodorus mentions the exception of the woman being pregnant and having children. The authorities to which Mr. Steele refers are the 'Bâla-Chandra Sâstra,' the 'Mitaksharâ,' and some others of the greatest weight. How far and under what conditions Hindu lawgivers allow the self-immolation of widows, will appear from Raja Rammohun Roy's translation, pp. 196-266. The success which has attended the attempts of the British government to abolish the Suttee, is a sufficient proof that the natives themselves were not so averse to its suppression as had been expected. Alfonso de Albuquerque, when he established himself at Goa, prohibited the burning of a widow alive; but since that time no attempt was made to follow up what he began until 1821, when a man who had assisted at a Suttee was tried for murder before an English court of justice. In 1826 the government declared the burning of a widow without the body of the deceased (*anumarana*) illegal; and all persons, whether relations or others, aiding or abetting in such an act, either before or after the death of the husband, were to be committed for trial at the circuit courts, and were made liable to the punishments for murder and homicide. Also the burning of a widow under the following circumstances was declared illegal: 1, if the widow is with child; 2, if the widow is under twenty years of age; 3, if the death of the husband has been occasioned by violent or accidental means; 4, if the previous written authority of the magistrate has not been obtained; 5, if the husband has a child under six or seven years of age; and 6, it was declared illegal for any other woman to be burnt than the legal widow by marriage, under any circumstances. In fact only those Suttees were considered lawful where the widow appeared in court and solicited permission in person from the magistrate, who had power to permit the performance of the rite. At the same time all the property, real and personal, in actual possession or otherwise of the deceased husband, and widow who performed Suttee under the sanction of the proper authorities, was declared to be forfeited to government. Moreover it was declared that no person should be eligible to any office under government in whose family a Suttee should take place after the promulgation of this regulation. It was however not until 1829 that a regulation was passed, on the 14th December, by the governor-general Lord W. Bentinck, in council, consisting of Lord Combermere, W. B. Bailey, and C. T. Metcalfe, declaring the practice of Suttee, or of burning or burying alive the widows of Hindus, with or without the body of the deceased (*anumarana* or *sahamarana*), to be illegal and punishable by the criminal courts.

The mode of burning is the same throughout India, varying only according to the rank of the deceased or the province where it is performed. The accounts of all Eastern travellers abound with instances of Suttees; it will be sufficient here to give a short sketch of the ceremony. The husband is directed by the physician, when there are no hopes of his recovery, to be carried to the river side, and the wife then breaks a small branch from the mango-tree, takes it with her, and proceeds to the body, where she sits down. The barber paints the sides of her feet red; after which she bathes, and puts on new clothes. During these preparations the drum beats a certain sound, by which it is known that a widow is about to be burnt with the corpse of her husband. On hearing this, all the village assembles. The son, or, if there be no son, a relation, or the head man of the village, provides the articles necessary for the ceremony. A hole is dug in the ground, round which stakes are driven into the earth, and thick green stakes laid across to form a kind of bed, upon which are laid abundance of dry faggots, hemp, clarified butter, and other combustibles. The widow now presents her ornaments to her friends, ties some red cotton on both wrists, puts two new combs in her hair, paints her forehead, and puts some parched rice and cowries into the end of the cloth which she wears. While this is going forward, the dead body is anointed with clarified butter and bathed, prayers are repeated over it, and it is dressed in new clothes. Ropes and another piece of cloth are spread upon the pile. The widow walks seven times round the funeral pile, strewing parched rice and cowries, and then she ascends the pile, or rather throws herself upon it.

From returns published in a parliamentary paper (*Hindoo Widows*, 178, sess. 1830), it appears that the numbers who were burned or buried alive in the presidency of Bengal was 583 in 1822, 575 in 1823, 572 in 1824, 639 in 1825, and 518 in 1826. In the presidency of Bombay the number was 158 for the four years ending 1827. No return is given from the Madras presidency. In the province of Benares the average age of widows who immolated themselves varied from forty-four to fifty-six years, in the several years from 1820 to 1825: none were under twenty, and several exceeded eighty years of age.

(Ward's *Hindoos*, ii. 99; Elphinstone, *History of India*, *Parliamentary Papers on Suttee*; Sir John Malcolm's *Memoir of Central India*.)

SUTTON. [NOTTINGHAMSHIRE.]

SUTTON, T. [CHARTERHOUSE.]

SUTURE, in Anatomy. [ARTICULATION: SKELETON.]

SUTURE, in Surgery, is the method of sewing together the edges of wounds; and the term is also applied to the threads with which the operation is effected.

The only wounds in which the application of sutures can be beneficial are those of which the edges, if held together, are likely to unite. They are therefore improper in all contused wounds, in the majority of lacerations, and in those wounds which extend so deep that, though the superficial parts might be brought together, the deep ones would remain open. But in cleanly-cut wounds, whose edges can be placed and kept in contact without any painful stretching of the parts adjacent to them, sutures are, if applied with proper cautions, by far the most convenient and secure method of obtaining a speedy reunion.

The necessary cautions are, that they should not be allowed to remain in the wound till they excite acute inflammation, and that, if from any cause the wound become inflamed, they should be at once removed. In general thirty-six hours are sufficient for a wound through the skin and the superficial parts to unite so far that it does not need sutures to keep its edges in contact. After this time therefore the sutures should be removed; and in cases of deeper wounds, and of amputations, it will not be necessary to retain them more than twenty-four hours longer.

The several kinds of suture employed in surgery are named the interrupted, the uninterrupted, and the twisted.

In the first, the edges of the wound, having been duly cleaned, are brought together by several single stitches placed an inch or more apart. A threaded curved needle is passed through the skin from one side of the wound to the other, so as to include about one-third of an inch of healthy skin on each side of it, and then, the needle being cut off, the two ends of the thread are tied pretty firmly in a double knot over the line of the wound. This is repeated as many times as the length of the wound requires, and the spaces between the successive sutures, where the edges of the wound usually gape a little, may be held together by sticking-plaster. The latter alone will suffice when the sutures are removed.

In the uninterrupted or glovers' suture, a single thread is carried alternately from one side to the other along the whole length of the wound, the needle being in each stitch passed from the border of the wound towards the adjacent healthy skin. There are only two kinds of cases in which this mode of suture can be usefully employed, namely, first, in certain wounds of the stomach and intestines, when those organs are to be returned into the abdomen, and it is of the highest importance that every part of the opening into them should be closed, so that their contents may not escape; and, secondly, in ordinary cuts of the palm of the hand or the fingers, where, the cuticle being thick, the uninterrupted suture may be made without pain; for in these cases, if a fine needle and thread be used, it is not necessary to pass them so deep as the cutis, and no inflammation can be excited by the holes made in the cuticle.

The twisted suture is employed for wounds in those parts of the skin which are very loose, and in which it is desirable to obtain a very exact union by the first intention, such as the lips, the eye-lids, the cheeks, &c. Instead of threads, one or more pins are passed across the wound and through the adjacent skin, and the edges of the former being brought together, are retained in their places by coils of silk wound like the figure 8 upon the projecting ends of the pins. This is the mode of suture commonly employed after the operation for hare-lip. [HARE-LIP.]

With all kinds of sutures it is of the highest importance that the dressings over them should be very light and cool. It is probably owing to the neglect of this caution, and of that already given respecting the time during which they should be retained, that some surgeons have been led to regard sutures as more mischievous than beneficial, ascribing to them the injuries produced by the injudicious management of other parts of the treatment.

SUVO'ROV-RYMNIKSKI, ALEXANDER VASSILYEVICH, COUNT, PRINCE ITALINSKI, field-marshal and generalissimo of the Russian forces, one of the most celebrated generals of the eighteenth century, was born in Finland, on the 13th November, 1730. His family was of Swedish origin, and, before its settlement in Russia, was called Suvor. The father of Suvórov had distinguished himself in the army, and had been promoted to the rank of général-en-chef in the reign of Catherine I. Upon his retiring from service, he was made senator, and lived at his country-seat in the south of Russia, upon a moderate income which his services had procured him. The predilection he had for a military life induced him to put his son in the army at the age of thirteen years. Young Suvórov remained in the regiment of Semenov until 1754, when, in the twenty-fifth year of his age, he obtained a lieutenancy in a regiment of the line, and distinguished himself so much, that three years after the date of his commission he was raised to the rank of first lieutenant, and in 1758, when the war with Prussia broke out, he was entrusted with the command of the garrison of Memel. But this situation was ill-suited to the active spirit of young Suvórov, whose energies demanded a far wider field of action. He begged to be sent on active service. His petition was granted, and in 1759 he was present at the battle of Kunnersdorf. He continued in the rank of first lieutenant until the death of the empress Elizabeth, when the Russian troops were recalled from Prussia. Suvórov, who during the war had received the approbation of his superior officers, was dispatched in 1763 to announce to the court of St. Petersburg the return of the Russian army. A letter of introduction brought him before Catherine II., who named him colonel of the Astrakhan regiment of infantry. Five years afterwards he was commanding officer of a part of the Russian troops which were engaged in warfare with the confederation of Bary in Poland. Here he first showed how worthy he was of the command entrusted to him: in a time almost incredibly short he dispersed the armies of both Pulawskis, took Cracow by storm, and obtained so many advantages over the enemy, that the success of the campaign has chiefly been attributed to him. On his return he was made major-general, and such was the fame he had already acquired, that in 1773 he was sent against the Turks: field-marshal Rumyantsow was commander-in-chief. Three victories by Suvórov over the troops of Mustapha III., which were commanded by the khan of the Crimea, prepared for the complete defeat of the Turks, and having effected a junction with the army of General Kamenskoy, a fourth victory put an end to the contest. This battle, one of the most sanguinary in this war, was fought at Kasledgi, about the end of June, 1774. In the mean time Pugacheff, a Cossack of the Don, who pretended that he was Peter III., had assembled a numerous army. A formidable insurrection threatened to overthrow the throne of Catherine; the negotiations with the Ottoman Porte had scarcely terminated when Suvórov was ordered to meet the insurgents. He settled the troubles, and soon restored perfect tranquillity to the empire. In 1783 he subjugated the Cuban Tartars and those of Budziac, and having forced them to swear allegiance to the Russian crown, the empress raised him to the chief command, which he held throughout the second Turkish war, which broke out in 1787. He had now no superior to bear off the credit of his actions, and could show that his skill as a tactician was fully to equal his courage. Suvórov was well aware of the enormous responsibility which now lay upon him; his measures therefore were extreme, and although he is accused of having sacrificed too many lives, he cannot be charged with not exposing his own. It was in this war that he first made almost exclusive use of the bayonet, which afterwards so much distinguished the Russian troops. In the battle of Kinburn, in 1787, he ordered his regiments of infantry to throw away their knapsacks and to attack the enemy with the bayonet. The Turks, who occupied a position much stronger than he suspected, repelled the repeated attacks of the Russians; Suvórov himself was wounded, his cavalry fled, and the Cossacks retreated from the field of battle. In this critical moment Suvórov, regardless of his wound, mounted his horse, overtook his flying horsemen, and, throwing himself in the midst of them, exclaimed, 'Run, cowards, and leave your general to the mercy of the Turks.' The effect was instantaneous, and notwithstanding the disadvantages he had to contend with, the battle was won. Nevertheless his courage frequently led him into difficulties which he could have avoided, as at the siege of Oczakow (December 17, 1788), where he would have been irretrievably lost, if Prince Repnin had not come to his assistance. The celebrated battle of Fokshany, which took place on the 1st of August, 1789, between the Seraskier Mehmet Pasha and the Prince of Coburg, who commanded a part of the Russian army, was chiefly won through Suvórov's intrepidity. In September of the same year the Prince of Coburg was surrounded by the Turks; and the Russian army stationed on the river Rymnik was in imminent danger. Suvórov reached the spot with a comparatively small force; the armies met on the 22nd September, and the Turks were completely defeated. It was for this victory that the emperor Joseph II. raised him to the rank of count of the empire, and Catherine to the dignity of a Russian count with the name of Rymnikski (*i.e.* he of the Rymnik).

The fortress of Ismail had in the course of this war withstood repeated attacks from the Russian armies. Prince Potemkin at last gave orders to Suvórov for its reduction. Suvórov was determined to take the fortress; he promised his soldiers the plunder of the place, and ordered them to give no quarter. The evening before the storming, he said to his soldiers: 'To-morrow morning, an hour before daylight, I shall rise, say my prayers, wash myself and dress, and then crow like a cock, and you will storm according to my orders.' The signal was given, and the army began the attack. The Russians were twice forced to give ground under the overwhelming fire of the enemy: at last they succeeded in scaling the walls. Thirty-three thousand Turks were killed or severely wounded, and ten thousand were made prisoners after the slaughter had ceased. Suvórov's report to the empress on this occasion is laconic: 'Praise be to God, and praise be to you: the fortress is taken, and I am in it.' Eight days were required for burying the dead. Suvórov took a horse to supply the place of

the one he had lost in the action, and this was all the share he had in the booty.

In 1792, when peace was made between Russia and the Porte at Yassy in Moldavia (January 9), the empress Catherine appointed Suvórov governor-general of the province of Yekaterinoslaw, the Crimea, and the lately acquired provinces round the mouth of the Dniester. Kherson was the chief town in these districts, and there Suvórov remained two years. In 1794, when the Poles revolted, Suvórov received the command of the regiments destined to repress the insurrection. He gained several victories over the insurgents, and the storming of Praga, which was taken after a desperate fight of four hours, and which opened to him the gates of Warsaw, on the 9th of November, reduced the Poles to obedience. On this occasion Catherine made him a field-marshal, and gave him a staff of command made of gold, with a wreath of jewels in the form of oak-leaves, the diamonds alone of which were valued at 60,000 roubles.

In 1795 Catherine died, but Suvórov did not lose any of his authority. In 1799 the emperor Paul gave him the command of the troops which fought in Italy against the French. The Russian armies combined with those of Austria, and Suvórov was appointed to the chief command. His brilliant victories, as those of Piacenza, Novi, and Alessandria, and the activity with which he took from the French all the towns of Upper Italy, procured him the title of Prince Italinski. In consequence of a change in the plan of operations, he crossed the Alps and Mount St. Gothard, in order to help Prince Korsakov in the neighbourhood of Zürich. Through mismanagement on the part of the Austrians, Suvórov came too late, and Korsakov was defeated by Massena, and obliged to retreat over the Rhine. This mishap, as well as the want of energy shown by the Austrians, obliged Suvórov to retreat as far as the lake of Constance. His object was to join the army of Korsakov. The French generals tried to prevent this junction. Suvórov was surrounded by them, and entirely enclosed in the valley of the Reuss. On the 28th of September he threw himself into the valley of Schlacken, and led his men, one by one, along a footpath, known only to chamois hunters, over steep rocks and bordered by deep abysses, into the village of Mulden, where Korsakov's troops were stationed. The extraordinary behaviour of the Austrian army and the apathy of the court of Vienna roused the indignation of Paul, and he recalled his forces. The protestations of Suvórov were in vain, and his representations regarding the necessity of the war being continued were rejected. Meanwhile the emperor had given orders for the reception of the generalissimo. He was to make a triumphal entry into St. Petersburg, and apartments were prepared for him in the Imperial palace. Scarcely however had Suvórov arrived in Russia, when a severe illness obliged him to stay at his country-seat in Lithuania. The emperor's own surgeon was dispatched to him. Yet in the midst of the preparations for Suvórov's triumphal procession Paul changed his mind; a circumstance so trifling as to be scarcely worth mention withdrew the imperial favour from a man to whom Russia was most deeply indebted. Suvórov learnt in Riga that he was in disgrace; nevertheless he continued his journey to St. Petersburg, and was received in the house of a niece. Sixteen days after his arrival at St. Petersburg, on the 18th of November, 1800, Suvórov died, at the age of seventy.

His funeral was celebrated with great solemnity, and 15,000 of his soldiers accompanied his body to the grave. The emperor Alexander erected in St. Petersburg, in 1801, a colossal statue of the first of Russian generals. Suvórov was an extraordinary man. Though thin and of a weak constitution, he maintained himself in good health by severe exercise and cold baths. He slept on a bed of straw or hay, under a light blanket, and his food was the same as that of his soldiers. Change in his fortune did not induce him to change his diet. His wardrobe consisted merely of his uniform and a sheepskin. Owing to this temperate mode of life, he preserved his youthful vigour even in his old age. He was very strict in performing all the duties of the Russian church, and compelled all who were under his command to observe them with the same strictness: on feasts and Sundays he used to read to them from religious books. He never gave the signal for a battle without making the sign of the cross and kissing the image of St. Nicholas. He was equally firm in his resolves and true to his promises; and his quickness of decision showed itself in the short and laconic style of his orders. A studied conciseness was likewise observable in his conversation, where, as well as in his writings, he frequently used rhyme. His rough and uncouth manners made him the favourite of his soldiers, for whom he had peculiar terms of endearment. Although he used to say that the whole of his tactics consisted in the two magic words, *Stupay i bey!* ('Advance and strike!') he showed in the course of his career great skill in the higher parts of the art of war. He was averse to all petty regulations with regard to dress and the like. His well-known remark upon Paul's introducing pigtails and curls, that curls would not serve for guns, nor queues for lances, might have been dangerous to him had it come to the ears of the emperor. That he might be more careful in his expressions and composed in his behaviour, he gave orders to his adjutants to check any rising passion by reminding him of the orders of field-marshal Suvórov; and he always obeyed. Once he forgot himself so far as to strike a soldier: the adjutant came up to him and said, 'Field-marshal Suvórov has ordered that no one should be overcome by anger.' 'Did he say so?' said Suvórov; 'well, we must obey.' Courage, determination, and quickness in executing his plans, were qualities in which Suvórov has scarcely ever had an equal. He has been accused of cruelty and blamed for want of deliberation; nevertheless he is one of the few generals who never lost a battle.

(Anthing, *Versuch einer Kriegsgeschichte des Grafen Suvorov*, 3 vols., Gotha, 1796-1799 (this work has been translated into English, and published under the title, *History of the Campaigns of Count Alexander Suworow Rymnikski*, 2 vols., London, 1799); Geo. von Fuchs, *Anecdotes of the Life of Count Suvorov*, Leipz., 1829; Fr. von Smitt, *Suvorow's Life and Campaigns*, 2 vols., Vilna, 1833. The correspondence of Suvórov has been published by Sergius Glinka, in 2 vols., Moskow, 1810.)

His son General Arcadius Alexandrovich Suvórov was drowned in the Rymnik, in 1820; and his nephew Prince Sergius Suvórov, a man of remarkable talents, has lately been appointed commanding officer in the Circassian war. Having received a foreign education, he does not speak Russian, a circumstance much to be lamented in the only descendant of the great Suvórov.

SUZOOS, a nation of Western Africa, whose territory extends north-westward from the neighbourhood of the river Kisseo, beyond the Rio Pongas, and nearly as far as the Rio Nunez, or from 9° 25′ to 10° 40′ N. lat., and in the widest part from 12° 15′ to 13° 36′ E. long. The Suzoos have another country, their native seat, more inland, beyond the sources of the rivers Kisseo and Scarcies, probably as large as this, but which is less known and the limits less determined, and the inhabitants of which are distinguished as Benna Suzoos. The two territories might have been described as one before the continuity was broken by a tribe of Mandingoes, who drove out the Suzoos and established themselves upon the rivers Kissee and Berreria. Of the tract first indicated the Suzoos dispossessed a nation called the Bagoes, who were once masters of the whole of the Rio Pongas and of the country between that river and the Rio Nunez, as well as of a considerable line of sea-coast extending from the Rio Nunez southward to the river Dembia, opposite the Isles de Los. They have still a few villages among the Suzoos, but are chiefly confined to the coast and to the islands, upon the largest of which (Tamara) they have plantations and villages. The Suzoo capital is Kanoffee, upon the river Pongas. The Suzoos are under a chief or king, but all matters of much importance are debated and concluded in the palaver, or national council, whose decisions are however inoperative if the king withholds his consent. In critical times, extraordinary palavers are held, attended sometimes by as many as 3000 or 4000 men. Three-fourths of the people are slaves to the other fourth; and it is said that there is a marked difference, not only in carriage, but in person, between the free and the servile races. The Suzoos generally are of inferior personal appearance to their neighbours the Bagoes, Bulloms, and Timannees: there is more of a yellow hue in the complexion, the lips are more thick, and the nose flatter. Like them, they shave until the beard turns grey with age, and then let it grow. Their food and habits of life are the same as those of the other pagan negroes of this quarter. All of them are fond of spirituous liquors, but the Suzoos have a peculiar drink, which they

use as beer, and which they prefer to palm-wine. It is tolerably palatable, and is obtained by the fermentation of the ashes of a plant called Yin-yung infused in water. The population of the Suzoo towns ranges from 1000 to 3000: they are commonly surrounded by a lofty palisade of bamboos, or by a wall of sun-dried bricks protected by a sloping thatch from the rains. The Suzoos are mostly pagans, although Mohammedanism has been making progress among them, through the example and exertions of the Mandingoes. They however pay a kind of worship to a god, and never undertake an affair of importance without sacrificing to him a bullock, with which a feast is afterwards made. White they deem a colour agreeable to their god; and they are said to pray, for that reason, with a white fowl or a sheet of white paper in their hand. Among them is a secret society called *Semo*, the members of which have a language of their own, and are marked by incisions (chiefly abdominal) in a peculiar manner. The novices live for a year apart in the woods, where none but the initiated dare intrude. The Suzoo language is to the ear the most agreeable of the African dialects, approaching in softness to the Italian. It is not only spoken throughout a considerable space near the coast, but is also the language of the extensive district called Jallonkadoo, and is understood by great numbers of the Foulahs, Mandingoes, Bulloms, and Timannees. The church missionaries have composed a grammar and reading lessons in this language, and the Gospel of St. Matthew has been translated into it.

(Matthews's *Voyage to the River Sierra Leone;* Winterbottom's *Account of the Native Africans in the Neighbourhood of Sierra Leone;* M'Lachlan's *Travels into the Bagoe and Suzoo Countries; Missionary Register.*)

SVENDBORG. [FÜNEN.]

SWABIA. [SUABIA.]

SWAFFHAM. [NORFOLK.]

SWALLOWS, *Hirundinidæ*, a family of insectivorous birds, in which the powers of flight are very highly developed, but which have the feet comparatively weak.

Belon placed the Swallows at the end of his birds, immediately following his *Petit Mouchet* or *Moineau de Haye*, which is engraven with a fly in its mouth. Brisson arranges the Swallow, together with the Goat-sucker, in his eighth order, consisting of birds which have the bill very small, compressed horizontally at its base, and hooked at its end, its aperture being larger than the head. This order stands between that containing *Upupa* and *Promerops* and that containing *Tangara* and the Finches.

The genus *Hirundo* is placed, in the twelfth edition of the *Systema Naturæ*, between *Caprimulgus* and *Pipra*, in the second division of the *Passeres*, viz. *Curvirostres, Mandibul. superior. apice incurvata.* In Latham's method it also appears in the second section of the *Passeres*, which is characterised much in the same way. In Lacépède's arrangement, *Hirundo* and *Caprimulgus* form his third order of birds (1st subclass and 1st subdivision) with *Bec très court*, standing between the antecedent order, consisting of those with the *Bec droit et menu* (the last genus of which is *Motacilla*) and the succeeding one, comprising birds with *Bec arqué*, the first genus of which is *Glaucopis*. M. Duméril arranges the Swallows in his sixth family (*Planirostres* or *Omaloramphes*) of the *Passeres*. Meyer's *Chelidones* (his sixth order) consist of *Hirundo, Cypselus*, and *Caprimulgus*. The same genera appear in Illiger's method as his family *Hiantes*, the last of his order *Ambulatores*. In Cuvier's system the Swallows and Goatsuckers, including *Podargus*, form his family *Fissirostres*, which stands between the *Dentirostres* and *Conirostres*. M. Vieillot's *Chelidons* are placed between his *Baccivores* and his *Myothères*, in his second tribe (*Anisodactyli*). M. Temminck's eighth order, embracing the Swallows and Goatsuckers, stands between the orders consisting of the Kingfishers and the Pigeons. In M. Latreille's method the first genus of the first family (*Latirostres*) of his second order (*Passereaux*) contains the Goatsuckers and Swallows.

Mr. Vigors states that the families which compose the first tribe (*Fissirostres*) of his second order (*Insessores*) are distinguished from those of all the other, except the *Tenuirostres*, by their habit of feeding on the wing. From the latter, or the *Suctorial Birds*, which meet them at one of the extremes of the tribe, and of which the typical families feed also on the wing, they are distinguished, he observes, by their animal food, which they take by their bills or in the gape of their mouths; while the *Tenuirostres* live chiefly upon vegetable juices, which they extract with their tongue. 'The *Fissirostres*,' says Mr. Vigors in continuation, 'depending so much on the powers of their wings, exhibit a proportional deficiency in the strength of their legs. These members are not only shorter and weaker than in the other *Perchers* (the typical families of the *Tenuirostres* here again being excepted, which correspond with them in this particular also), but they have their external toes in general to such a degree united with the internal, for the most part as far as to the second phalanx, that they are deprived of the free play of the joint; and the bird is thus rendered nearly incapable of using its legs in walking, or for any purpose besides that of mere perching. But even in this particular a group of the typical family appears deficient; for the toes of the genus *Cypselus*, being all placed in front, seem to assist the bird only in suspending itself, where other birds would perch. All the families of the tribe are again united by a striking conformity in their mode of nidification. They deviate from the manners of the *Perchers* in general in forming their nests on the ground; or if, like some of the *Hirundinidæ*, they choose elevated situations for that purpose, they build up the exterior of their nests with earth cemented into a solid substance, and thus preserve a similarity in their construction to those nests which are actually formed on the ground. The two typical groups of this tribe may be observed to be separated from the other three by the shortness of their bills and the wider gape of the mouth. Their mode of seizing their prey is conformable to these characters: they receive it in full flight into the cavity of their mouths, which remain open for that purpose, and where a viscous exudation within, and a strong reticulated fence of *vibrissæ* on the exterior, assist in securing the victim: while, on the other hand, the longer-billed families catch their food by their bills. The series of succession in the tribe may be stated as follows, the typical families being placed in the centre:—

'*Meropidæ.*
Hirundinidæ.
Caprimulgidæ.
Todidæ.
Halcyonidæ.'

After alluding to the approximation between the *Meropidæ* and *Hirundinidæ*, Mr. Vigors notices the union between the latter and the *Caprimulgidæ*. [NIGHT JARS, vol. xvi., p. 224.]

M. Latreille makes the *Latirostres* the first family of his second order (*Passereaux*); and the first division of the family comprises the Goatsuckers and the Swallows. In the method proposed by M. de Blainville in 1815 and 1821, and developed by M. Lherminier in 1827, the *Martinets* (*Cypselus*, Ill.) form the seventh family and the *Engoulevents* (*Caprimulgus*, Linn.) the eighth of the first subclass (Normal Birds), the sixth being the *Colibris* (*Trochilus*, Linn.), and the ninth the Cuckows (*Cuculus*, Linn.).

Mr. Swainson, as we have seen [CAPRIMULGIDÆ, vol. xvi., p. 225], enters the family of *Hirundinidæ*, which, he observes, present many singular variations of structure among themselves, by the *Balassian Swift*. In the true Swifts (Cypselus), the hind-toe, he remarks, is so placed that it can be brought nearly forward, and all four are armed with very strong crooked claws, giving to the bird such a firm grasp that it can sustain itself by the side of perpendicular rocks or buildings with the greatest facility. 'Others,' says Mr. Swainson in continuation, 'with less robust feet (*Chætura*, Stev. (Steph.)), are compensated for the deficiency by being furnished with a very stiff and pointed tail, which serves as an additional support, when resting in such situations. In the long-winged Swifts of India (*Macropteryx*, Sw.) all these characters are modified, and we see the Swifts changed almost into the Swallows. The two typical groups of the *Fissirostres* are thus united, and both may be characterised by a very short bill. The third group, as usual, contains three others, all exhibiting, more or less, a similar economy, but having the bill considerably more lengthened.'

The genera comprised in the family by Mr. Swainson are *Cypselus* (with the subgenera *Cypselus, Macropteryx*, and *Chætura*) and *Hirundo*.

The Prince of Canino arranges the *Hirundinidæ* as the second family of the *Passeres*, and in the first section of

that family (*Ambulatores**). The following are the Prince's subfamilies and genera:—

a. Cypselinæ.

Genera:—*Cypselus*, Ill.; *Chætura*, Sw.

b. Hirundininæ.

Genera:—*Progne*, Boie; *Chelidon*, Boie; *Cotyle*, Boie; and *Hirundo*, Linn. (*Cecropis*, Boie). The family stands between the *Caprimulgidæ* and the *Ampelidæ*.

Mr. G. R. Gray divides the *Fissirostres* into two subtribes:—1. *Fissirostres nocturnæ*, consisting of the family *Caprimulgidæ*, with its subfamilies; and, 2. *Fissirostres diurnæ*, the first family of which last subtribe is *Hirundinidæ*, with the following subfamilies:—

1. *Cypselinæ.*

Genera:—*Cypselus*, Ill. (*Apus*, Scop.; *Micropus*, W. and Mey.; *Hirundo*, L.), *Macropteryx*, Sw. (*Macropterus*, Sw.), *Hemiprocnes*, Nitzch., *Acanthylis*, Boie (*Chætura*, Steph.; *Hirundo*, L.), *Collocalia*, G. R. Gray (*Hirundo*, L.).

2. *Hirundininæ.*

Genera:—*Hirundo*, L. (*Cecropis*, Boie), *Progne*, Boie (*Hirundo*, Gm.) *Cotyle*, Boie (*Hirundo*, L.), *Chelidon*, Boie (*Hirundo*, Vieill.).

European Swallows.

The European species of this family are the *Swift* (*Cypselus Apus*, *Cypselus murarius*, Temm.); the *White-bellied* or *Great Gibraltar Swift* (*Cypselus Melba*, *Cypselus Alpinus*, Temm.); the *Rock-Martin* (*Hirundo rupestris*); the *Rufous Swallow* (*Hirundo rufula*, Temm.); the *Chimney Swallow* (*Hirundo rustica*, Linn.); the *Martin* (*Hirundo urbica*, Linn.); and the *Sand-Martin* (*Hirundo riparia*, Linn.) Of these the first and the three last are British (summer visitors); and of the second, three specimens have been killed, and one found dead in Britain. (Yarrell.)

Cypselus.—Tarsus thickly feathered. All the four toes directed forwards; the two middle equal. The hallux, or inner toe, shorter than the exterior. Tail forked or even. (Sw.)

Head and foot of Common Swift. (Sw.)

Belon considers this to be the Ἄπους (*Apus*) and κυψέλλος, or κύψελος (*Cypsellus*, *Cypselus*) of Aristotle (*Hist. Anim.*, ix. 30); and indeed Aristotle states that it would be difficult to distinguish these ἄποδες or κυψέλλοι from Swallows (χελιδόνες), if it were not that the former have the leg covered with feathers (δασεῖαν). M. Camus however thinks that those zoologists who are of opinion that Aristotle had here the Swifts in view are wrong; for the latter says (*loc. cit.*) that the birds thus designated by him made long nests of mud, with only just room enough to enter, which, M. Camus remarks, Swifts do not, but House-martins do; and therefore he thinks the birds last named are meant.

The Common Swift, which usually comes to this country from Africa early in May, and leaves us generally by the middle of August, is the *Moutardier, Martelet, Martinet noir ou Grand Martinet* of the French; *Rondone, Dini*, and *Dardano* of the Italians; *Ring-swala* of the Swedes; *Thurm Schwalbe* of the Germans; *Gier Zwaluw* of the Netherlanders; *Screech, Screech Martin, Deviling, Screamer*, and *Black Martin* of the country-people in various parts of Britain; and *Martin dû* of the antient British.

'This species,' says Pennant, 'is the largest of our Swallows; but the weight is most disproportionately small to its extent of wing, the former being scarcely one ounce, the latter eighteen inches; the length near eight inches. The feet of this bird are so small, that the action of walking and rising from the ground is extremely difficult; so that nature hath made it full amends by furnishing it with ample means for an easy and continual flight. It is more on the wing than any other Swallows; its flight more rapid, and that attended with a shrill scream. It rests by clinging against some wall or other apt body, from whence Klein styles this species *Hirundo muraria*. It breeds under the eaves of houses, in steeples, and other lofty buildings; makes its nest of grasses and feathers, and lays only two eggs, of a white colour. It is entirely of a glossy dark sooty colour, only the chin is marked with a white spot. The fabulous history of the *Manucodiata*, or *Bird of Paradise*, is in the history of this species in great measure verified. It was believed to have no feet, to live upon the celestial dew, to float perpetually on the Indian air, and to perform all its functions in that element. The Swift actually performs what has been in these enlightened times disproved of the former; except the small time it takes in sleeping, and what it devotes to incubation, every other action is done on the wing. The materials of its nest it collects either as they are carried about by the winds, or picks them up from the surface in its sweeping flight. Its food is undeniably the insects that fill the air. Its drink is taken in transient sips from the water's surface. Even its amorous rites are performed on high. Few persons who have attended to them in a fine summer's morning but must have seen them make their aërial course at a great height, encircling a certain space with an easy steady motion. On a sudden they fall into each other's embraces, then drop precipitately with a loud shriek for numbers of yards. These birds and swallows are inveterate enemies to hawks. The moment one appears, they attack him immediately: the swifts soon desist; but the swallows pursue and persecute those rapacious birds till they have entirely driven them away.'

Temminck states that the Swift lays three or four pure white eggs. Mr. Yarrell (*British Birds*) remarks that in windy days the bird will remain for hours in its retreat motionless and in the dark. 'How great,' says that practical ornithologist, 'is the contrast when on other occasions it is seen darting rapidly or wheeling in circles, and screaming aloud, while in pursuit of its insect food; at one time sailing with ease and pleasure at an elevation where the bird is scarcely perceivable, and at another passing the angle of a building, as has been observed, with the almost inconceivable swiftness of a meteor. Great power of vision seems indispensable both to enable the bird to obtain its food as well as to ensure its safety under such rapid movements; nor is even this power always sufficient to guard it against accident: a Swift on eager wing was seen in its flight to be carried against a wall; it was picked up stunned, and died almost immediately in the hand of the observer.'

In White (*Selborne*), to whom Pennant owed, as he acknowledges, much that he has written of the Swift and other *Hirundinidæ*, and in the author last quoted, will be found many highly interesting particulars relating to the habits of the Swift, especially with regard to the structure of the nest, its constant use (by the same birds, as has been proved in some instances) for years in succession, and the treatment of the young by the parents under certain circumstances. Mr. Salmon has verified the fact of their producing three, and sometimes even four eggs, though two appear to be the ordinary number.

The old quatrain, in the *Portraits d'Oyseaux*, sums up the qualities of the Swift thus:—

'Le Moutardier, ou bien grand Martinet,
Est à voler tres-leger et fort viste:
Mais sur la terre il ne pose, ny giste:
Car y estant, sur pieds mobile n'est.'

The bird appears to spread over Europe in the summer and breeding season. They visit Lapland, Norway, Denmark, and Sweden; in which last country Professor Nillson states that it makes its nest in hollows of trees in the woods. Its eastward range appears to be as far as the mountain-lake Baikal. At Erzerum it has been observed in numbers from May till September. Mr. Yarrell states that he has never seen this species in any collection brought from India. It has been noted at Madeira. Montagu extends its southward range in Africa as far as the Cape: Temminck limits it to the tropics. In our own country it has been remarked that Swifts are less plentiful with us than they formerly were. We cannot close our notice of the

* This term, used in like manner by Illiger, accords ill with the volatile habits and weak lower limbs of the Hirundinidæ.

European species without some account of the *Martin* or *House-Martin* (*Hirundo urbica*):—

> 'Ce martinet fait en forme sphérique
> Son nid si fort, qu' impossible est de mieux,
> En l'attachant aux bastiments fort vieux;
> Duquel l'entrée est estroicte et oblique.'

This summary in the *Portraits d'Oyseaux* is very characteristic, but the *modus operandi* of the architect is so admirably given by White, that no apology is necessary for introducing his description.

'A few house-martins,' says White, 'begin to appear about the 16th of April; usually some few days later than the swallow. For some time after they appear the *hirundines* in general pay no attention to the business of nidification, but play and sport about, either to recruit from the fatigue of their journey, if they do migrate at all, or else that their blood may recover its true tone and texture after it has been so long benumbed by the severities of winter. About the middle of May, if the weather be fine, the martin begins to think in earnest of providing a mansion for its family. The crust or shell of this nest seems to be formed of such dirt or loam as comes most readily to hand, and is tempered and wrought together with little bits of broken straws to render it tough and tenacious. As this bird often builds against a perpendicular wall without any projecting ledge under, it requires its utmost efforts to get the first foundation firmly fixed, so that it may safely carry the superstructure. On this occasion the bird not only clings with its claws, but partly supports itself by strongly inclining its tail against the wall, making that a fulcrum; and thus steadied, it works and plasters the materials into the face of the brick or stone. But then, that this work may not, while it is soft and green, pull itself down by its own weight, the provident architect has prudence and forbearance enough not to advance her work too fast; but by building only in the morning, and by dedicating the rest of the day to food and amusement, gives it sufficient time to dry and harden. About half an inch seems to be a sufficient layer for a day. Thus careful workmen when they build mud-walls (informed at first perhaps by this little bird) raise but a moderate layer at a time, and then desist; lest the work should become top-heavy, and so be ruined by its own weight. By this method in about ten or twelve days is formed an hemispheric nest, with a small aperture towards the top, strong, compact, and warm, and perfectly fitted for all the purposes for which it was intended. These industrious artificers are at their labours in the long days before four in the morning: when they fix their materials, they plaster them on with their chins, moving their heads with a quick vibratory motion. It has been observed that martins usually build to a north-east or north-west aspect, that the heat of the sun may not crack and destroy their nests: but instances are also remembered where they bred for many years in a hot stifled inn-yard against a wall facing to the south. Birds in general are wise in their choice of situation; but in this neighbourhood every summer is seen a strong proof to the contrary at a house without eaves in an exposed district, where some martins build, year by year, in the corners of the windows. But as the corners of these windows (which face to the south-east and south-west) are too shallow, the nests are washed down every hard rain; and yet these birds drudge on to no purpose from summer to summer, without changing their aspect or house. It is a piteous sight to see them labouring when half their nest is washed away and bringing dirt—

> —"generis lapsi sarcire ruinas."

'Thus is instinct a wonderful unequal faculty; in some instances so much above reason, in other respects so far below it.' (*Selborne.*)

It would be a waste of space and words to combat now the antient but long since exploded doctrine of the hybernation of swallows in holes and crevices and even under water. Some late birds may be unable to follow the march of their congeners southward, and be seen occasionally on a warm day after the rest are departed, or may be found in a semi-torpid state laid up in crevices, and be revived by the warmth of a fire: but these are exceptions to the great law of migration.

Generic Character of Hirundo.—Bill flattened its whole length; the margins not inflected. Rictus smooth. Feet insessorial. Lateral toes equal; middle toe longer than the tarsus. (Sw.)

ASIATIC SWALLOWS.

Macropteryx.—Tarsus remarkably short, naked. Anterior toes long; the outer scarcely shorter than the middle: the inner shortest; hinder toe very short. Tail long, forked. India. (Sw.)

Example, *Macropteryx longipennis.*

Description.—Above obscure glossy green; throat, breast, and lower part of the back light-grey; belly, spot on the scapulars, and line over the eye white; ears rufous; front with an incumbent crest.

Mr. Swainson, whose description this is, and who has given an elegant figure of the bird in the second series of his *Zoological Illustrations*, inquires whether the *Hirundo Klecho* of Dr. Horsfield (*Sambor-galeng* of the Javanese), which is described by the Doctor in the 13th vol. of *Linn. Trans.* as 8½ inches in length, is not the female of this species. Mr. Swainson considers *Macropteryx* intermediate between the typical Swifts and the Swallows. To the first, he remarks, it is allied by its strong scansorial feet; to the latter by the length and fixed position of the hind toe, and the depression of the bill.

Head and foot of Macropteryx longipennis.

We must here notice the Indian species, *Hirundo esculenta*, which makes the edible nests that form a considerable article of Chinese commerce. The species, which is the *Lawet* of the Javanese, is small. It is brown above, and whitish beneath and at the end of the tail, which last is forked. The nests are made of a particular species of *Fucus* [SEA-WEEDS, vol. xxi., p. 156] which the bird macerates and bruises before it employs the material in layers so as to form the whitish gelatinous cup-shaped nests so highly prized as delicacies and restoratives by the Chinese when dissolved in their soups. Bontius, who seems to have thought that the nest was formed of no vegetable material, says of these birds, 'ex spuma maris basin scopulorum alluentis, tenacem quandam materiam colligunt, sive ea Balænarum seu aliorum piscium sit semen, ex qua nidos suos ædificant, in iisque ova ponunt, et pullos excludunt.' The nests are affixed to the rocks, and the finest are semi-transparent. Coarse or dirty nests are used for glue, but the good ones are eagerly sought after. 'Chinenses hos nidos e scopulis avulsos, ingenti quantitate per Indiam venales ferunt, gulosis in summas delicias, qui eos gallinæ, seu vervecis decocto dissolutos, avidè devorant, et ostreis, fungis, et cæteris gulæ irritamentis, longè anteponunt.' This recipe for making the famous birds'-nest soup ends a chapter which begins poetically and pathetically with the following lines:—

> 'Quid scopulos, Progne, quid inhospita littora nidis
> Optas, per medias hos gula quæret aquas?'

There is another species, *Hirundo fuciphaga*, the *Linchi* of the Javanese, about five inches long, nearly an inch shorter than *Hirundo esculenta*, which has a white abdomen and longer wings in proportion to its size. This species constructs its nests of mosses and lichens connected by the same glutinous substance which composes the edible nest of *Hirundo esculenta*. Dr. Horsfield, who states this in his *Systematic Arrangement and Description of Birds from the Island of Java* (*Linn. Trans.*, vol. xiii.), there remarks that the specimens of *Hirundo esculenta* examined by him in Java and those which he brought home differ from Latham's description in being uniformly of a blackish-colour without a white extremity to the *rectrices*. Bontius, who gives a rude cut of the nests adhering to the rock, with the birds sitting and approaching, describes his birds, in the chapter '*De nidis hirundinum edulibus*,' above referred to, as 'Aviculæ parvæ discolores, hirundinum specie.' Specimens of *Hirundo esculenta* and *Hirundo fuciphaga* are preserved in the museum of the East India Company.

AFRICAN SWALLOWS.

Example, *Hirundo Senegalensis*.

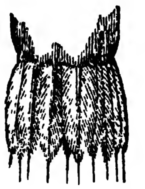
Description.—Large; tail forked; plumage above glossy-black; sides of the nape and neck, and lower part of the back, rufous; beneath ferruginous, verging to white on the throat and breast; under wing-coverts and thighs pure white. (Sw.)

This is the *Senegal Swallow* of authors; *Le Grande Hirondelle à ventre roux de Senegal.*

Mr. Swainson, who has given a most characteristic figure of this species in his 'Birds of Western Africa,'* observes that this is the largest of the true swallows that he has yet seen, for it measures full eight inches in its total length. 'Its structure,' says that observing author, 'is precisely similar to our common *Hirundo rustica*, excepting that the hind toe and claw, which in that bird is of equal length with the shank, is in this a slight degree longer. In the general cast of its colouring it has such a close resemblance to the *Hirundo Capensis* figured by Le Vaillant as an inhabitant of the Cape of Good Hope (*Ois. d'Afr.*, 5, pl. 245, *fig.* 1), that we were at first tempted to believe it was the same, particularly as Le Vaillant forgets to give us the size of his bird, an omission which all the compilers since his days have perpetuated. It appears however that the Cape species has a small white spot on the inner web of all the lateral tail-feathers, excepting that which is elongated, and that the feathers of the vent have a black stripe down the middle of each.' In the same volume will be found a description of the small but very beautiful *White-bodied Swallow, Hirundo leucosoma*, Sw.

AMERICAN SWALLOWS.

Chætura,† Steph.—Feet as in *Macropteryx*, but the tarsus longer than the middle toe. Tail short, even; the hafts prolonged into acute points. (Sw.)



Tail of Chætura. (Swainson.)

The type of this genus is *Chætura Pelasgia*, Steph., *Hirundo Pelasgia*, Linn., of which we shall presently treat.

Chætura macroptera—Long-winged Swift. (Swainson, *Zool. Ill.*, 2nd series.)

Of the *Chætura macroptera*, which is brown, with the wings and tail glossed with greenish-blue, the back being of a grey-white, the chin and under tail-covers snowy, and the tail even, Mr. Swainson says that *Hirundo albicollis* and it are two of the largest species yet discovered of a very singular group of swifts; wherein the tail-feathers are spined, and even more rigid than those of the woodpeckers: by this structure, he remarks, the birds can remain for a considerable time in the most perpendicular situations. The expanded tail, he adds, thus acts as a powerful support, which is further increased by the size and strength of the claws, these last being much larger than those of ordinary swallows. Most of the species are natives of America, but Mr. Swainson does not say whether this is a native of that country.

The species of *Hirundines* enumerated by Nuttall, in his interesting 'Manual of the Ornithology of the United States and Canada,' are, the *Purple Martin* (*Progne purpurea*, Boie; *Hirundo purpurea*, Linn.); the *Barn Swallow* (*Hirundo rufa*, Gm.; *Hirundo Americana*, Wils.); the *Fulvous* or *Cliff Swallow* (*Hirundo fulva*, Vieill.; *Hirundo lunifrons*, Say); the *White-bellied Swallow* (*Chelidon bicolor*, Bonap.; *Hirundo bicolor*, Vieill.; *Hirundo viridis*, Wils.); the *Bank-Swallow* or *Sand-Martin* (*Cotyle riparia*? Boie; *Hirundo riparia*, Wils.); and the *Chimney Swift* or *Swallow* (*Chætura Pelasgia*, Steph.; *Cypselus Pelasgius*, Temm.; *Hirundo Pelasgia*, Linn., Wils.).

Our limits will only permit us to notice two of these highly interesting birds, and we will take the first and the last.

The male *Purple Martin* is dark-bluish glossy purple: the wings and forked tail are brownish-black. The female and young are bluish-brown, and have the belly whitish. Tail considerably forked. Length about 8 inches. Alar extent, 16.

'This beautiful species,' says Nuttall, 'like many others of the family, seeks out the dwellings of man, associating himself equally with the master and the slave, the colonist and the aboriginal. To him it is indifferent whether his mansion be carved and painted, or humbled into the hospitable shell of the calabash or gourd. Secure of an asylum for his mate and young, while under the protection of man, he twitters forth his gratitude, and is everywhere welcomed to a home. So eager is he to claim this kind of protection, that sometimes he ventures hostilities with the Blue-birds and domestic pigeons, whom he often forces to abandon their hereditary claims. Satisfied with their reception and success, like so many contented and faithful domestics, they return year after year to the same station. The services of the martin in driving away hawks and crows from the premises he claims are also important inducements for favour: he has even the courage to attack the redoubtable King-bird,* when his visits are too familiar near the nest. At the approaching dawn the merry martin begins his lively twitter, which, continuing for half a minute, subsides until the twilight is fairly broken. To this prelude succeeds an animated and incessant musical chattering, sufficient, near the dwelling, to awaken the soundest sleeper. His early vigils are scarcely exceeded by the domestic cock: the industrious farmer hears the pleasing call to labour, and associates with the favourite bird the idea of an economical, cheerful, and useful guest. In the Middle States, from the 15th to the 20th of April, the martins begin to prepare their nest, which is usually made of small green or dry leaves, straws, hay, and feathers, laid in considerable quantities. The eggs, pure white, are from four to six, and without spots. They rear two broods in the season. Several pairs also dwell harmoniously in the same box. The male, very attentive to his sitting mate, also takes part in the task of incubation; and his notes at this time have apparently a peculiar and expressive tenderness. The food of the martin is usually the larger winged insects; as wasps, bees, large beetles, such as the common *Cetonia* or goldsmiths, which are swallowed whole. His flight possesses all the swiftness, ease, and grace of the tribe. Like the swift, he glides along as it were without exertion. Sometimes he is seen passing through the crowded streets, eluding the passengers with the rapidity of thought; at others he sails among the clouds at a dizzy height, like something almost ethereal.'

The chimney swift, or swallow, is sooty-brown, and has the chin and line over the eye of a dull whitish. It is about

* 'Naturalist's Library,' Ornithology, vol. viii.

† Employed in entomology and botany.

* Tyrant Flycatcher, *Milvulus Tyrannus*, Bonap., *Muscicapa Tyrannus*, Linn.

$4\frac{1}{2}$ inches in length, but 12 in alar extent. The wings extend far beyond the tail, which is even, and, like that of the rest of the genus, mucronate.

'This singular bird,' says the interesting author last quoted, 'after passing the winter in tropical America, arrives in the Middle and Northern States late in April or early in May. Their migrations extend at least to the sources of the Mississippi, where they were observed by Mr. Say. More social than the foreign species, which frequent rocks and ruins, our swift takes advantage of unoccupied and lofty chimneys, their original roost and nesting situation being tall gigantic hollow trees, such as the elm and buttonwood (*Platanus*). The nest is formed of slender twigs, neatly interlaced somewhat like a basket, and connected sufficiently together by a copious quantity of adhesive gum or mucilage secreted by the stomach of the curious architect. This rude cradle of the young is small and shallow, and attached at the sides to the wall of some chimney or the inner surface of a hollow tree: it is wholly destitute of lining. The eggs are usually four, and white. They have commonly two broods in the season. So assiduous are the parents, that they feed their young through the greater part of the night: their habits however are nearly nocturnal, as they fly abroad most at and before sunrise, and in the twilight of evening. The noise which they make while passing up and down the chimney resembles the rumbling of distant thunder. When the nests get loosened by rains, so as to fall down, the young, though blind, find means to escape by creeping up and clinging to the sides of the chimney-walls: in this situation they continue to be fed for a week or more. Soon tired of their hard cradle, they generally leave it long before they are capable of flying. On their first arrival, and for a considerable time after, the males, particularly, associate to roost in a general resort. This situation, in the remote and unsettled parts of the country, is usually a large hollow tree open at top. These well-known *Swallow-trees* are ignorantly supposed to be the winter-quarters of the species, where, in heaps, they doze away the cold season in a state of torpidity; but no proof of the fact is ever adduced. The length of time such trees have been resorted to by particular flocks may be conceived perhaps by the account of a hollow tree of this kind by the Rev. Dr. Harris, in his journal. The *Platanus* alluded to grew in the upper part of Waterford in Ohio, two miles from the Muskingum; and its hollow trunk, now fallen, of the diameter of $5\frac{1}{2}$ feet, and for nearly 15 feet upwards, contained an entire mass of decayed swallow-feathers, mixed with brownish dust and the exuviæ of insects. In inland towns they have been known to make their general roost in the chimney of the court-house. Before descending, they fly in large flocks, making many ample and circuitous sweeps in the air; and as the point of the vortex falls, individuals drop into the chimney by degrees, until the whole have descended, which generally takes place in the dusk of the evening. They all however disappear about the first week in August. Like the rest of the tribe, the chimney swift flies very quick, and with but slight vibrations of its wings, appearing as it were to swim in the air in widening circles, shooting backwards and forwards through the ambient space at great elevations, and yet scarcely moving its wings. Now and then it is heard to utter, in a hurried manner, a sound like *tsip tsip tsip tsee tsee.* It is never seen to alight but in hollow trees and chimneys, and appears always most gay in gloomy weather. The wonderful account of the swallow-roosts in Honduras, given by Captain Henderson, appears to be entirely applicable to this species.'

Hirundo fasciata. (Sw., *Zool. Ill.*, 2nd series.)

As an example of the more southern *Hirundinidæ*, we select the *Hirundo fasciata* of Latham.

Description.—Glossy blue-black; thighs and band on the abdomen snowy.

This is *L'Hirondelle à ceinture blanche* of Buffon, the *White-bellied Swallow* of Latham.

Mr. Swainson speaks of this as a very rare bird; and, according to Buffon, it is sometimes seen perched on floating trees in the rivers of Guiana. Length to the end of the deeply forked tail about six inches. The first quill is longest.

We shall treat of the Australian WOOD-SWALLOW (*Artamus*) under that title. There are several species, but they can hardly be classed with the true swallows, though they approximate to them in some points. Their bills and feet remove them from the *Hirundinidæ*.

SWAMMERDAM, JOHN, was born at Amsterdam in 1637. His father was an apothecary in that city, and was celebrated for a large collection of objects of natural history and other curiosities which he had formed. His grandfather first took the name of Swammerdam from the place of his birth, a village on the Rhine between Leyden and Woerden.

John Swammerdam was originally intended for the church, but he preferred medicine. During his preparatory studies, following the example of his father, he devoted himself with great ardour to the study of natural history, and especially that of insects, in which he is said to have obtained, even while a young man, far more knowledge than the writers of all preceding ages. In 1651 he went to Leyden, and studied under Van Horne and Francis Sylvius. He applied himself very diligently to minute dissections of the human body, and, bringing with him the tact which he had acquired in the examination of insects, was eminently successful. After two years' residence at Leyden he went to Saumur in France, where he continued his observations upon insects, and in 1664 discovered the valves of the lymphatics, but lost the full credit of his industry by Ruysch having at the same time made similar observations, and published them before his were printed. From Saumur Swammerdam went to Paris, and lived with Nicholas Steno, with whom he had been a fellow-pupil and an intimate friend at Leyden. Here also he gained the acquaintance of M. Thévénot, who was afterwards his chief patron, and obtained leave for him, on his return to Amsterdam, to dissect the bodies of those who died in the hospital. In 1666 he went again to Leyden, and made numerous anatomical researches in company with Van Horne. Early in the following year he first employed the method of preparing the blood-vessels by means of waxen injections, and was soon after admitted doctor of medicine: his thesis was an essay on respiration. About this time also he invented the method of making dry preparations of hollow organs, which is now usually employed.

After receiving his diploma, Swammerdam devoted nearly all his time to the study of the anatomy and the natural history of insects; and in 1669 he first published his general history of them. In 1672 he communicated to the Royal Society of London some plates of the human uterus, together with an account of his injections of the spermatic vessels, and some specimens of the success of his invention. At this time also he was engaged in numerous dissections of fishes, especially of their glands; and made several useful investigations respecting the pancreatic fluid. In 1673 he discovered an important error in the received opinions respecting hernia; and proved that when the intestine is protruded, the peritoneum is not torn, but stretched, so as to form a saccular prolongation from the lining of the abdomen; a fact which was first published, with several other results of Swammerdam's inquiries, in Schrader's observations. In the same year he published his treatise on

the natural history of bees; 'a work,' says Boerhaave, 'which all the ages from the commencement of natural history have produced nothing to equal, nothing to compare with.' But the labour it had cost him, and the incessant fatigue to which he had been exposed in making microscopic observations for hours together under the heat of a burning sun, destroyed his health, which had always been delicate, and he determined to sell his museum, and renounce all his former pursuits for a religious life, for which his desire had been excited by Antoinette Bourignon, with whom he had long maintained a correspondence. But it was not easy to find a purchaser for so extensive a collection: his friend Steno, on the part of the duke of Tuscany, offered him 12,000 florins for it if he would become a Roman Catholic; but this he angrily refused, and Thévénot tried in vain to dispose of it in France. While various negotiations were pending, he completed the arrangement of his museum, and made catalogues of it; and in 1675 published his last work, on which he had been engaged for more than ten years, 'The Anatomy of the Day fly.' In 1676 he went to Copenhagen with another disciple of Antoinette Bourignon, to obtain from the king of Denmark leave for her to reside in his kingdom, the Lutheran divines of Holland having endeavoured to remove her from Holstein. His application however was unsuccessful; and on his return to Amsterdam he found his father enraged at him for his continued neglect of all profitable employment, and determined to allow him but an insufficient income for his maintenance. He was in utter despair what course to pursue consistently with his anxiety for a life of quietude and religion. In a few months his father died. Instead however of inheriting money enough for the purpose of his retirement, he found himself involved in a dispute with his sister respecting the division of the property, which, with his continued anxieties about the sale of his museum, brought on a severe illness, with melancholy, and he died early in 1681.

Swammerdam left all his manuscripts on insects to Thévénot; after whose death, having passed through several different hands, they were bought by Boerhaave, and published in one volume. His heirs endeavoured to obtain 5000 florins for his museum, but in vain; and it was at length broken up and sold in small portions to different purchasers. All the works of Swammerdam were translated from the Dutch into Latin by Gaubius, and most of them at different periods into English, French, and German. Boerhaave, with his edition, published a Life of the Author, which is added to the English translation of 'The Book of Nature, or the History of Insects,' by Thomas Floyd, folio, London.

SWAN RIVER, a river which takes its rise in the Darling Mountains, on the western side of New Holland. It was discovered by Vlaming, a Dutch navigator, in 1697, who gave it the name of Swan River on account of the number of black swans which he observed on its banks. The mouth of the Swan River is in 32° 4′ N. lat. and 115° 40′ E. long. The entrance of the channel is obstructed by a bar of rocks. Higher up it is narrow, and is then seven or eight feet in depth. After half a mile the navigation is free, and in mid-channel the depth is not less than eight or nine feet. The river then turns in a northerly direction for seven miles without any large bends. On the eastern bank there are two shoals, but on the opposite side there is a passage. Farther up, the river forms a basin two miles and a half wide, beyond which it is blocked up by shoals and islets (Harrison's Isles), between which the depth is not more than two or three feet; but it gradually deepens from five to fifteen feet. The river is then not more than one-third of a mile wide, and it continues in a winding course with a channel from seven to ten feet deep. It then becomes unfit for the navigation of vessels of burthen. Capt. King does not mention the length of the Swan River, nor does its exact source appear to be known. (King's *Survey of the Coasts of Australia.*)

SWAN RIVER, the name generally given to all that part of New Holland between the parallels of 31° and 35° 8′ S. lat., and to the westward of 119° E. long.

Coast.—The coast of Swan River is characterised by numerous æstuaries, each of which receives several rivers, which respectively discharge into the sea by a narrow mouth. It is deficient in good harbours. The best is in Cockburn Sound, in 32° 10′ S. lat., which is described by Sir James Stirling as perfectly secure at all times, and capable of receiving the largest vessels, as well as any number of them. It is however by other authorities stated to be encumbered with rocks. King George's Sound, in 35° 6′ S. lat. and 118 E. long., is perhaps the next. Its position however exposes it to strong easterly gales. Harbours for boats and small vessels also exist near the entrance of Peel's Inlet (32° 30 S. lat., 115° 34′ E. long.), Augusta (34° 18′ S. lat., 115° 8′ E. long.), and Cape Riche (34° 4′ S. lat., 119° E long.); but those which have been named are all which merit notice.

Mountains, &c.—About fifty miles from the coast of Swan River is a range of hills called the Darling Mountains, extending nearly the whole length (north and south) of the colony, and varying from 800 to 1600 feet above the level of the sea; or, according to other accounts, to 2000 feet. St. Anne's and Mount William are said to attain 3000 feet. The Darling range has not been fully explored, though it has been crossed in many directions by straggling parties in search of land. With few exceptions it is described as a sterile belt, the surface consisting in great measure of hard red-sandstone: in some places the granite appears in masses. There is a profusion of coarse herbage on it, and numerous plants resembling the English heath, with forests of large mahogany and blue gum-trees. Mr. Ogle specifies several minerals which have been discovered in different parts of the Darling Mountains: roofing-slate, lime, marl, selenite, silicious and calcareous petrifactions, magnetic iron-ore, peacock iron-ore, chromate of lead, crystals of quartz; and he adds, on the authority of Capt. King, copper. Nearly all the rivers which flow to the westward appear to take their rise in the Darling Mountains. The Stirling range of hills contains several mountains of considerable height: Toolbrunup, 3000 feet; Koi-kyenneruf, 2500 feet; and Hume, 1800 feet. (Ogle's *Western Australia.*)

The valleys of this part of Australia are of two kinds: those which are almost ravines, bounded by inaccessible cliffs; and wide valleys, bordered by fertile plains, which occur where the basaltic rocks are developed. 'The soil found in the valleys of the former kind is extremely rich, but they are all subject to very heavy inundations. The sandstone formation is intersected in all directions by valleys of this kind, which are seldom more than from two to three miles apart.' The richest land is found in the valleys of the second class. (Ogle and Grey, *Journal of the Royal Geographical Society*, No. 1, vol. i.)

Along part of the coast south of the Swan River there is a continuous calcareous ridge. In this part no gramineous plants are to be found, but several species of herbaceous plants rise out of the sandy surface, which afford tolerable nutriment for sheep and cattle. Adjoining this district of light sandy soil is a considerable breadth of red land, in an easterly direction, extending to the base of the Darling Mountains, the soil of which varies from red sandy loam to the richest clay and red marl, and is apparently fit for all agricultural purposes. The fourth variety of country is the uneven surface of the mountain-range, which is of granite and trap formation. The valleys of this range are exceedingly rich and verdant, and the hills themselves, though occasionally rugged, owing to the protrusion of the rocks, contain magnificent timber and very excellent sheep-lands. The fifth and last variety of soil is that which is found on the banks of the rivers and streamlets. It is alluvial, and generally very rich, bearing spontaneously good native flax, many edible roots, and thirty or forty species of grasses. This description of the country applies more particularly to the extent of about forty miles to the southward of the Swan River. Farther south the sandy tract disappears, and the rocky ground is less protruding.

In that part of Swan River which borders on the south coast there are three distinct parallel ranges of mountains running from north to south. The highest and most eastern of these has its southern termination near to King George's Sound, in 35° 6′ S. lat. The second terminates at Cape Chatham, 35° S. lat. Cape Leuwin, in about 34° 20′ S. lat., is the southern termination of the third range, which is inferior in altitude, as well as in extent, to the other two: it terminates on the north at Cape Naturaliste, 33° 27′ S. lat. On these ranges, and in their intervening valleys, the soil varies according to position and altitude. On the mountains and higher hills the surface is rugged and stony; in the lower sides of both the soil is excellent; but in the principal valleys and the lower grounds, where the sandstone formation prevails, it is of a very inferior description, except where the alluvial deposit of the rivers gives it a different character. (*Report* of Captain Stirling, in 'Journal of the Royal Geographical Society,' vol. i.)

Captain Bannister, who travelled in a south-easterly direction from Freemantle, 32° 2′ S. lat., to King George's Sound, has described the country between these places. His party passed the Darling range near the summit of St. Anne's Hill. The hills are here exceedingly rugged, but covered with the finest timber, known in the colony by the name of mahogany. In some of the valleys he found the soil tolerably good, of a light hazel colour, with abundance of herbage fit for cattle on their passage from a good interior country to the coast; on the uplands ironstone, with a little gravel and scrub. From the higher range of the Darling Mountains to about 117° 15′ E. long. the distance was computed to be about forty miles, and the character of the country traversed was generally not good, but there were tracts of excellent land. Pursuing a south by east course for eighty or ninety miles, a very great proportion of the land was fit for sheep, or the plough, or cattle. 'The beauty of the scenery near to and distant from the rivers which we crossed,' says Captain Bannister, 'is equal to any I have seen in the most cultivated timber country in those parts of Europe which I have happened to pass through. The character of the country generally is undulating, with here and there moderately high hills, some of them crowned with rocks of granite, pudding-stone rocks, and a blue stone: but there are broad flat lands and valleys, the former of which not unfrequently extended several miles, even in some places far beyond our power to ascertain. The hills were in general so gradual in their ascent, that where those of a rougher character were seen, they only gave a certain character that destroyed the dull feeling of the mind which a mere flat country engenders in many.' Changing his course to the south and south-west by west, he perceived from some high mountains nothing but one vast forest, twenty to thirty miles distant, the intermediate country presenting occasional open valleys winding between apparently high hills to the eastward. Changing again to due south, he traversed a country as rough as can be imagined. In two days his party could not travel more than seven or eight miles, toiling the whole of each day, owing to the dense scrub. To the eastward of Cape Chatham the country was wooded and hilly, but the soil occasionally rich. The forest-trees were the mahogany, and the red and white gum. On the higher hills and on the poor lands, the former predominated; on the lower lands and sides of the hills, where good land was, the latter: there were also the usual trees, such as Banksia, tea-tree, &c. To the south-west and west the underwood was so thick for many miles, that it was with the greatest difficulty a passage could be made: occasionally Captain Bannister's party were obliged to make a road with a hatchet. Some of the trees were very large: they were principally blue gum; 'and if others had not seen them,' says Captain Bannister, 'I should be afraid to speak of their magnitude. I measured one: it was, breast-high, 42 feet in circumference, and in height before a branch, 140 or 150, we thought at least, and as straight as the barrel of a gun.' Within a few miles from the sea, sand-hills, very difficult to pass over, were encountered; they had however abundance of grass.

The country between Augusta and Perth, that is, between about 34° 8′ and 31° 53′ S. lat., is of the same unequal character as that which has been described. According to the report of Mr. Busfield, in the neighbourhood of Augusta the land is very sandy, and the timber of minor growth. To the north it improves; the trees are of a larger size, and very thick; the prevailing timber is white gum, and on the bad land in general mahogany. Farther on in the same direction the soil deteriorates; tracts of sand occasionally and granite rocks abound in extensive fields; the country is hilly, but contains no elevation of sufficient height to command a view. 'After about a mile and a half of such a country,' says Mr. Busfield, 'we came to a large flat, abounding in Banksia, grass-trees, and a swampy vegetation: this flat was a black sand, with however a considerable admixture of soil.' Beyond this in a westerly direction the country was found to be more hilly, and rivulets were more frequent; the land fertile, but encumbered with timber of stupendous size, all white gum. A portion of the country traversed toward the sea-coast is thus described: 'The hills I had lately left stretched apparently to a great distance, in a line with the coast; they constituted a limestone range, the rock of solid texture.... The soil was generally sandy and barren, but where the least symptom of an admixture of mould showed itself, the grass-tree, of stunted stature, as though just struggling for existence, was always seen, and sometimes in extensive tracts..... We encountered a valley, the most difficult of passage of anything I have ever yet met with in the shape of bush: its vegetation consisted solely of shrubs advanced to a larger standard than usual in this country; the ground (I suppose in consequence of perpetual shade and want of circulation) was covered with moss, and on this we were obliged to crawl under the thicket, while sliding down and climbing up the numerous and steep ascents and acclivities in which the place abounded.' (*Collection of Papers on Western Australia.*)

Rivers.—The rivers on the west coast of Australia generally rise at no great distance from the sea. Near their sources they are mountain-torrents, but in the low lands they become slow streams. They are liable to sudden rises, which are caused, Capt. Grey supposes, by the rain which falls in those parts where they have their source. At other times their channel, in some places many feet deep, is quite dry. They offer little or no facility for internal navigation. Besides the Swan, there are the Avon, the Murray, the Canning, the Harvey, the Preston, the Collie, the Vasse, the Blackwood, the Donnelly, and the Kalgan. (*Western Australia*, by Thomas John Buckton.)

The Canning rises in the Darling range: it is smaller than the Swan, and only navigable for a few miles. Shoals impede the navigation, and in dry weather boats must be pushed over them for fully half a mile. The Canning enters the south side of Melville Water, about five miles south from Perth. The Murray takes its rise also in the Darling range, and empties itself into Peel's Inlet. The Preston and the Collie unite about fifty miles south of the Murray, and run into an æstuary called Leschenhault, and form a bar, over which the river is very shallow. (Ogle, *Western Australia*, 1839.)

For the Botany and Zoology of Swan River, see the article Australia.

Climate.—The climate of Swan River has the same general character as that of Eastern Australia. [Australia.] It has not generally been found prejudicial to Europeans, while in the case of some persons it has proved highly favourable. Major Irwin represents the temperature as resembling that of the south of Italy, parts of Spain and Portugal, and the Cape of Good Hope. According to thermometrical observations at Perth, the capital of the colony, situated in about 31° 53′ S. lat. and 115° 50′ E. long., the maximum and minimum height of the thermometer in the shade in the month of January (1831) was 106° and 68°; February, 102° and 62°; March, 96° and 60°; April, 98° and 48°; May, 78° and 44°; June, 70° and 38°; July, 67° and 33°; August, 76° and 42°; September, 78° and 45°; October, 79° and 48°; November, 95° and 54°; December, 96° and 60°. But though thus variable, the western part of New Holland is not so uncertain as New South Wales in the supply of rain and moisture. This is obviously explained by its more mountainous character, and by the prevalent winds. According to observations made in Perth, in 1831 also, the state of the weather in the successive months of the year was—January, generally fine and very sultry; February, thunder on the 7th, 13th, and 14th, with rain in these days; March, rain on the 27th and 28th, at full moon, remainder fine; April, fine, with the exception of three rainy days; May, much rain and heavy dews; June, lightning and thunder on the 8th, 12th, and 13th, frequent showers, but neither long-continued nor heavy; July, the greater part fine—severe thunder-storm on the 8th, ice on the 9th, thunder on the 16th; August, a good deal of rain, a strong gale on the 5th; September, mostly cloudy, and occasional showers, thunder on the 2nd, 10th, and 19th; October, variable, cloudy, and rainy for the greater part; November, squally, cloudy, and rainy at beginning, latter part fine; December, generally fine, a regular land and sea breeze, with a little rain. (*Report of Dr. Milligan of the 63rd Regiment.*)

Major Irwin divides the seasons into wet and dry, and represents the first as beginning generally in March and ending in November, the rain not being heavy except in August and September. The height of the dry season is during the harvest, in January, when the nights are distinguished by heavy dews. The seed-time lasts from early in May to the end of August. By December the grain is ripe: hay is cut in November. Tomatos, pumpkins, gourds, vegetable-marrow, chillies, egg-plants, besides every English vegetable, ripen in the open air; and also the following among other

fruits—melons, bananas, almonds, figs, grapes, peaches, and strawberries. The olive, pomegranate, apricot, plum, mango, lemon, and orange; the mulberry, apple, nectarine, pear, and several others, give promise of succeeding, but they have been scarcely proved yet. Fig-cuttings produce fruit the first year, and vines the second or third. (Irwin, *State and Position of Swan River*.)

Natives.—It appears from the reports of Major Mitchell and of Captain Grey, who have respectively travelled in the eastern and western parts of Australia, that the natives of the latter are superior in intelligence and humanity to those of the former. They live in patriarchal subjection, choosing a chief only in time of war. Polygamy is general. Marriages are regulated by certain rules. No man can marry a woman of the same family-name as himself, and the children take the family-name of the mother. The sons inherit the property of the father, and the land is of course never for two generations in the hands of men bearing the same family-name; and in the event of the head of a family having had several wives of different family-names, his land is divided among several new families. The country is thus divided into comparatively small properties, the boundaries of which are strictly defined. (Captain Grey's *Travels*, vol. ii., p. 232, 233.)

They hold an annual fair, called *Mundja*, which takes place in the spring of the year, when the natives of different districts meet for the purpose of exchanging various articles of utility with one another; the Murray men and the Perth men meet, and the following exchanges take place between them: the Murray men bring the girdle of opossum's hair worn round the waist, a long straight spear, the native knife, the dow-uk,* a dog's tail, a tuft of feathers, burnt ochreous clay, a tuft of cockatoo feathers, the string of opossum's hair worn round the head, &c. The Perth men bring a hammer, a cloak, the hair of the opossum spun into thread, a stone, &c. When they meet, the following ceremony takes place: they rapidly pass fire-sticks from hand to hand, endeavouring to drop a small piece of lighted wood on the females in such a manner that they get slightly burned before they can shake it off. In passing the fire-sticks from hand to hand, they also endeavour to do it so dexterously as to burn the person they give them to. (Captain Grey's *Vocabulary of the Dialects of Western Australia*.)

Their huts are not always so miserable as they have been represented. They are constructed with sticks in a bee-hive shape, for the accommodation of a family, and are covered with the bark of the *Melaleuka*, or tea-tree. This bark is a soft cottony substance, and strips off the tree in large flakes. The entrance is made on the side sheltered from the prevailing winds: here they kindle their fire, toward which they stretch their feet when they lie down.

Neither is their cooking so bad as it is supposed to be. Major Irwin, speaking of the way in which they dress fish, tells us that he has often partaken of it with them, and that it would be no disgrace to a Parisian cook. The fish, after being washed and prepared, is wrapped in soft bark, and placed in hot ashes. 'By this process an acid from the bark is communicated to the fish, imparting so agreeable a flavour, that no other sauce is required.'

They are superstitious. No death results from natural causes, but always from sorcery, according to their belief. A magician or doctor, called *Mulgarradock*, is recognised among them; he is considered to possess the power of driving away wind or rain, as well as of bringing down lightning or disease upon an obnoxious individual. The hand of the Mulgarradock is supposed to confer strength or dexterity, and he is frequently applied to for that purpose. The operation by which strength and dexterity are imparted consists in simply drawing the hand repeatedly, with a firm pressure, from the shoulder downwards to the fingers, which are afterwards extended until the joints crack.

Their funeral solemnities are peculiar. A grave is dug about four feet long and three wide, perhaps a yard in depth. The earth that is removed is arranged on one side of the grave in the form of a crescent; at the bottom is placed some bark, and then small green boughs; and upon this the body is laid, ornamented and enveloped in a cloak, with the knees bent up to the breast and the arms crossed. Over the body are heaped more green boughs and bark, and the hole is then filled with earth. Green boughs are placed over the earth, and upon them are deposited the spears, knife, and hammer of the deceased, together with the ornaments that belonged to him; his throwing-stick* on one side, and the curl† or towk on the other side of the mound or grave. The mourners then carve circles in the bark of the trees that grow near the grave, at the height of six or seven feet from the ground; and, lastly, making a small fire in front, they gather small boughs, and carefully brush away any portions of the earth that may adhere to them. They then colour their faces black or white, laid on in blotches across the forehead, round the temples, and down the cheek-bones; and these marks of mourning are worn for a considerable time. They also cut the end of the nose and scratch it, for the purpose of producing tears. During the period of mourning they wear no ornaments or feathers. It frequently occurs that two individuals bear the same name; and in this case, if one should die, the other changes his name for a certain time, in order that the name of the deceased should not be uttered. When a female is interred, her implements‡ are likewise deposited in her grave. (Sir James Stirling.)

The *corroboree* dance, common to the natives of Australia and Van Diemen's Land, is remarkable. Major Mitchell has very graphically described this singular custom. 'The surrounding darkness,' says he, 'seems necessary to the effect of the whole, all these dances being more or less dramatic; the painted figures coming forward in mystic order from the obscurity of the background, while the singers and beaters of time are invisible. Each dance seems most tastefully progressive, the movement being at first slow, and introduced by two persons displaying the most graceful motions both of arms and legs, while others, one by one, drop in, until each imperceptibly warms into the truly savage attitude of the corroboree jump, the legs striding to the utmost, the head turned over one shoulder, the eyes glaring and fixed with savage energy in one direction, the arms raised and inclined towards the head, the hands usually grasping waddies§, bommerengs‖, or other warlike weapons. The jump now keeps time with each beat, and at each leap the dancer takes six inches to one side, all being in a connected line, led by the first dancer. The line is doubled or tripled according to space and numbers; and this gives great effect, for when the front line jumps to the left, the second jumps to the right, the third to the left again, and so on until the action acquires due intensity, when all simultaneously and suddenly stop.' (*Travels in Eastern Australia.*)

Language.—According to Captain Grey, there are the following arguments to prove that all the Australian dialects have a common origin: '1st, A general similarity of sound and structure of words in the different parts of Australia; 2nd, The recurrence of the same word with the same signification, to be traced in many instances round the entire continent, but undergoing various modifications; 3rd, The same names of natives occurring frequently at totally opposite portions of the continent. In all known parts of Australia it is ascertained that the natives name their children from any remarkable circumstance which may occur soon after their birth; such being the case, an accordance of the names of natives is a proof of a similarity of dialect.'

It is a singularity observed in reference to the dialects of Australia, that those of districts widely removed from one another sometimes assimilate very closely, whilst those spoken in the intermediate ones differ considerably from either of them. In a comparison embracing Swan River (Perth), King George's Sound, South Australia, and Sydney, the degree of similarity is exhibited in Tables by Captain Grey. For the word smoke the expression used in the first is booyoo; in the second, poou; in the third, puiyu; in the last, poito. For water, kowin, koin, kowe, kokoin; for wood, kalla, kal, karla, kollai; for the hand, mara, murr, murra, mutturra; for the eye, mail, mil, mena, mael. This com-

* *Dow-uk*, 'a short heavy stick, used in knocking down the smaller kinds of game, much in the same manner that poachers do hares and rabbits in England.'—(Grey.)

* Throwing-stick, called the *kiley*, 'is thrown into flights of wild fowls and cockatoos for the purpose of killing them.'—(Grey.)

† The *towk* is only another name for the *dow-uk*.

‡ Among the contents of a woman's bag, Captain Grey enumerates a flat stone to pound roots with; quartz, for the purpose of making spears and knives; stones for hatchets; needles made of the shin-bones of kangaroos shells used for cutting hair.—(*Travels*, vol. ii., p. 266.)

§ *Waddies*, a kind of club.

‖ *Bommereng*, a thin curved missile about 2 feet 4 inches long: it can be thrown by an accustomed hand so as to rise upon the wind with a rotatory motion, and in a crooked direction, towards any given point with great precision, and to return, after a considerable flight, to within a yard or two of the thrower; or, by first striking the ground near him, to bound, so as to hit at a given distance any object behind a tree.—(Mitchell.)

parison embraces dialects in use at distances of between two and three thousand miles, in countries differing totally in their vegetation, and in which the birds and reptiles are also in many instances different. These physical differences must account for the existence in one part of many words, original and derivative, not to be found in the other. The greatest resemblance is in words expressing ordinary actions, in personal terms, or in pronouns. With regard to the pronouns, in the singular, plural, and dual numbers they almost coincide in Western Australia, Southern Australia, and Sydney. The following are illustrations of this: nginnee, ngintoa, ninna; ngalee, ngalin, ngadli; nurang, nura, niwa; ngando, ngauto, ngando; ngannee, ngan, nganna; nganno, nganbo, ngangko. (Grey's *Travels*, c. ix., vol. ii.)

The natives of Western Australia are, like other savages, very fond of singing. 'To a sulky old native his song is what a quid of tobacco is to a sailor: is he angry, he sings; is he glad, he sings; is he hungry, he sings; if he is full, provided he is not so full as to be in a state of stupor, he sings more lustily than ever.' Their songs are naturally varied in form, but they are all represented to be concise, conveying in the simplest manner the most moving ideas. They quickly spread from tribe to tribe, until from change of dialect the very words are not understood by the people. The usual accompaniment to their songs is the clapping of hands, or the beating of a short round stick against the flat board with which they throw their spears. Some songs have a peculiar dance connected with them. Their music, although very different in character from that to which European ears are accustomed, is not without a power to move or to affect even a European listener. Captain Grey, speaking of their funeral chants, offers a testimony, which is given also by Major Mitchell. He says, 'Nothing can awake in the breast more melancholy feelings than the funeral chants of these people.' Several specimens of Australian songs are given in Captain Grey's *Travels*.

Among a people thus singular in their customs, and on the outskirts as it were of humanity, there are striking evidences of affinity to races far removed from them in local habitation and in social history. Customs entirely arbitrary in character, whose existence is not explained by similar wants and circumstances, are observed among the Australians, the distinct counterpart of which we find frequently mentioned in sacred history and in eastern travels. A collection of these may be seen in the interesting publications of the Aborigines' Protection Society. (See 'Extracts,' vol. ii., No. IV.)

No systematic attempt, worthy of the name, has yet been made to promote the civilization of the aborigines of Western Australia; but they have not been found deficient in capacity where it has been incidentally tested. They readily acquire a knowledge of the language, the customs, and the temper of their European neighbours, to whom they accommodate themselves with wonderful facility. It seems due to the unfortunate races whose territory our necessities oblige us to appropriate, that we should carry among them not our vices only, but so much of our religion and civilization as they can be made to receive. Major Mitchell, Captain Grey, and other travellers in Australia, appreciating the interests of settlers, as well as the claims of the natives, have strongly recommended the adoption of systematic measures for their improvement. (Aborigines' Protection Society's Papers, *Outline of a System of Legislation for the Benefit of the Aborigines of British Colonies.*)

Towns.—The capital of Swan River is Perth, which is situated on the Swan River, in 31° 53′ S. lat., 115° 50′ E. long. Messrs. Backhouse and Walker describe this town as it was above four years since, between which and the present time improvements may have been made; although, from the slow progress of emigration to Swan River, they cannot be great. 'The houses here (they say) are built at short distances from each other, surrounded by land, making the town cover a large surface compared to its population. The native blacks are numerous about Perth. They usually wear a small rug of Kangaroo skin about their shoulders, sometimes brought partially before; at other times hanging over their backs, and not unfrequently they walk about Perth in a state of nudity, which custom appears so to reconcile, that little pains are taken to discourage it. They cut wood, draw water, and perform many little offices for the European population.' 'Along the borders of the Swan River there are narrow alluvial flats of good land, which are chiefly cultivated with grain, of which a supply equal to the wants of the colony is raised. In the range of this country there are several small farming establishments within sight one of another, and a few large ones, for this country, are also interspersed.' Freemantle, near the mouth of the Swan River, consists of scattered houses. It is situated in a less fertile part of the country than Perth. Vines and figs however thrive in Freemantle upon little more than the limestone rock covered with sand. Augusta, and Albany at King George's Sound, are insignificant places.

Owing to the system on which colonization was carried out, population is much dispersed in Swan River.

History.—Swan River dates its history as a British colony from the year 1829. The favourable representations more especially of Captain Stirling, R.N., who became the first governor, led to its adoption as a place of settlement. The principle on which its colonization was commenced was erroneous, and involved the early settlers in severe trials, and the progress of the colony has ever since been tardy and discouraging. As a marked distinction from the other Australian colonies established at that time, it was determined that no convicts should be sent to Swan River. Along with this supposed advantage, land was to be disposed of at an exceedingly low price. Persons arriving in the settlement prior to the end of the year 1830, were to receive grants of land free of quit-rent, proportioned to the capital they were prepared to invest in it, at the rate of 40 acres for every sum of 3*l*. 'Investment of capital' was to imply stock of every description, implements of husbandry, and other articles applicable to the purposes of productive industry, or necessary for the establishment of the settler on his location. For the introduction of labouring persons an allowance of 200 acres for each adult labourer was to be made to the emigrant who paid for the passage of the labourer to the colony: women and children above ten years of age came under the description of labouring persons. After the date of 1830 grants were to be reduced to 20 acres for every 3*l*. capital; capital being represented as above. For the introduction of labourers, 100 acres for each labouring person were to be allowed (labouring persons included women and children above twelve years of age); and for every child under twelve and above six years, 60 acres; under six years, 30 acres.

In New South Wales and Van Diemen's Land, for many years prior to this, land had been granted free of all payment, in proportion to the capital possessed by the emigrant, and under this system those colonies had wonderfully advanced in population and in wealth. But while the land-granting system was in operation, the system of penal transportation was continually supplying the settlers with labourers, whose penal condition precluded them from becoming landed proprietors until their period of servitude was ended. Swan River however was founded on conditions which excluded this kind of labour, and allowed only of that which was free. Two elements, apparently conflicting, were thus brought together,—cheap land, and labourers in whose power it was to become landed proprietors. The consequence was, that the colony of Swan River was scarcely founded when the ambition of the labourers to become proprietors reduced the infant colonizing population entirely to the latter class, and for a time impeded all advance.

Shortly after this unfortunate issue, a petition was addressed by some of the colonists at Swan River to the home government, praying the repeal of that condition by which they were deprived of convict labourers.

Down to the year 1837 the disastrous influence upon the progress of the colony of the false principle of its colonization was apparent to two most intelligent travellers, members of the Society of Friends, who visited Swan River, after having spent several years in New South Wales and Van Diemen's Land, engaged purely in labours of benevolence, and uninterested personally in commercial speculations calculated to prejudice their representations. They say, 'We have often been reminded, since our arrival here, of the saying of a man in Van Diemen's Land (who had quitted Swan River in 1831): "It is a country to make one's heart break."' (See extracts from the communications of J. Backhouse and G. W. Walker, published by the Society of Friends.)

Latterly, important modifications which have been introduced into the system of colonization, considerable efforts which have been made to promote the emigration of capitalists and labourers, and chiefly the establishment of a new settlement in the proximity of Swan River, under the aus

pieces of the Western Australian Company, have contributed to brighten the prospects of the colony, and in a few years it will probably exhibit signs of health and hope equal to the other Australian colonies. The following statistical returns exhibit its social and commercial condition at the latest period in reference to which authentic information has been obtained. Revenue for the year ending March 31, 1841, 9650*l.* 8*s.* 2*d.*; shipping in 1838, which entered the harbours of the colony, 12,892 tons; in the year ending as above (1841), 30,000 tons. Exports of wool in 1838, 25,800 lbs.; in 1840-1, 50,000 lbs. Stock in the colony in 1838, including every kind, 21,939 head; in 1840, 40,000. The population in 1838 was between three and four thousand; in 1840-1, upwards of 4000. Churches and chapels are rapidly rising in the different settled districts, and several schools are established. Two newspapers are published weekly.

The colony is divided into fourteen counties:—Twiss; Perth; York; Murray; Grantham; Trellington; Wicklow; Sussex; Nelson; Goderich; Hay; Lanark; Stirling; Plantagenet.

Government.—The public affairs of the colony are administered by a governor, who is responsible for the exercise of his functions to the colonial department of the British government. The laws of the mother-country are incorporated into the local enactments by the governor and legislative council, and are enforced by a competent judicial establishment.

AUSTRALIND.—Australind is the name given to that part of Australia lying between Gantheaume Bay, in 27° 40′, and the Arrowsmith river, in 29° 30′ S. lat.

Captain Grey is the only traveller who has given a description of Australind. From his 'Journal' we collect such passages as the following:— In the morning completed my survey of the shores of Gantheaume Bay, and of the river, which discharges itself into the sea about the centre of the bay, and started in the afternoon to walk overland to Perth, distant about 300 miles in a straight line. We found the bed of a stream occupied by pools of water, which runs into the sea from the south-east through the opening in the south part of Gantheaume Bay, which is laid down upon Captain King's charts. The country hereabouts was composed principally of a sandstone rock resembling in character the antient sandstones of England, and differing altogether from the sandstone formations of the south-eastern portion of Australia: the form of the hills was that of a series of table-lands intersected by deep and rocky ravines, which were so narrow that the small extent of good land on them could scarcely be occupied, for in the rainy season the whole of the bottoms of these ravines must be flooded and occupied by the waters of mountain-torrents. The vegetation on the hills consisted chiefly of an almost impenetrable bed, composed of a species of tea-tree (of the colonists): in the ravines grass and trees of a larger growth were found. The country being of so impracticable a nature, our progress was slow and toilsome, and we halted for the night at the brow of one of the ravines, having climbed to the top of a cascade, down which the water was slowly dropping.' After travelling for upwards of an hour over a country corresponding to the above, on the following day Captain Grey fell in with a beaten native path, which ran along the summit of the table-land, winding round the heads of the ravines, and thus avoiding them. 'Travelled two and a half miles south by east over sandy downs thinly clothed with Banksia trees and scrub; one and a half miles south by east through a similar country. From this point the country changed its character from barren precipitous sandstone to gently sloping limestone hills and valleys, affording good feed for sheep and cattle. The limestone was of an altogether different character from the recent limestone formation found along the coast.' After travelling three miles south by east through a country of the nature above described, in which a spring of water was met with at nearly every half mile, the country was found by Captain Grey becoming densely wooded with a species of tea-tree, 'and it took us,' says Captain Grey, 'nearly two hours and a half to make as many miles in a straight line, and even then we were dreadfully torn by the bushes.' Travelling for some miles again over 'an indifferent country, consisting of elevated sandy downs covered with scrub and a species of Banksia,' Captain Grey then entered a rich and thickly wooded limestone valley, in which he found the most northern grass-tree (*Xanthorrhea*), and the most southern gigantic ant's nest;' from which circumstances of animal and vegetable life he concluded that he was entering 'that portion of the continent where the productions of the tropical and more temperate regions were becoming confounded, previous to an absolute change from the one to the other taking place.' 'For the next four miles we travelled,' says Captain Grey, 'south by east, along the native path, which ran through a low country composed of a rich soil, and which produced abundantly the warran, or native yam, which always grows in the most fertile districts.'

On the third day after leaving Gantheaume Bay the party reached a verdant and flourishing district, to which Captain Grey refers in the following terms: 'It seemed certain that we stood in the richest province of South-West Australia, and one which so differs from the other portions of it in its geological characters, in the elevations of its mountains, which lie close to the sea-coast, in the fertility of its soil, and the density of its native population, that we appeared to be moving upon another continent (vol. ii., pp. 15-16). This district has been named the Province of Victoria, and extends fifty miles north and south (between the parallels of 27° 30′ and 29° 30′ S. lat.), and is bounded on the east by a 'lofty chain of mountains, flat-topped, and so regular in their outline that they appeared rather the work of art than of nature.' They are distant from twenty to twenty-five miles from the coast, and were named by Captain Grey the Victoria Range. The country to the north and south is comparatively unproductive, and that on the north-east and south-east has not yet been explored. Of the whole Province of Victoria Captain Grey says: 'There is no other part of extra-tropical Australia which can boast of the same number of streams in an equal extent of coast frontage, or which has such elevated land so near the sea; and I have seen no other which has so large an extent of good country.' The principal river is the Hutt, but it is not known whether it is navigable, though Captain Grey supposes it to be so. There are two other considerable streams, the Buller and the Murchison.

The country examined during Captain Grey's expedition lies between Cape Cuvier and Swan River, having for its limits the parallel of 24° and that of 32° S. lat. Ten rivers were discovered, 'which are, when considered with reference to the other known ones of Western Australia, of considerable importance, some of them being larger than any yet found in the south-west of this continent: many smaller streams were also found.' Besides the Province of Victoria, two other extensive districts of good country were also found: one, the district of Babbage, situated in nearly the central part of the western coast of Australia, and watered by the river Gascoyne; and another, adjacent to Swan River, to which a name was not given. A second range of mountains, called Gairdner's Range, was also discovered, which, says Captain Grey, 'forms a very important feature in the geography of this part of Australia.'

The great recommendation of the settlement of Australind is a harbour superior to, or rather supplying the deficiencies of, those hitherto made available in Western Australia. This harbour, named in honour of the enterprising traveller whose name we have so frequently mentioned, Port Grey, is situated in lat. 28° 55′ S.: it is about four miles in length in the direction of the coast, and two miles and a half from within the reef from the coast, and may thus contain six or eight square miles of surface. It is protected by two headlands, which stretch from the coast to the westward; and from the northern headland runs out a reef of rocks nearly due south, thus extending the shelter against winds from the northward and westward. The anchorage is in seven fathoms at all parts of the harbour. (*The New Settlement of Australind*, by H. S. Chapman.)

The settlement of this part of Western Australia has scarcely more than commenced, under the auspices of the Western Australian Company, which has purchased from the British government a very extensive tract of country. The principle on which colonization is to be carried out is that which has been applied in South Australia. Land is disposed of at a fixed price for ready money; and a proportion of the fund thus raised is appropriated to the introduction of the various kinds of labourers which a young country requires; another proportion to the expenses of surveys, local administration, and other purposes.

Some hundred emigrants are already settled in Australind.

SWAN. In England the swan is said to be a bird royal,

in which no subject can have property, when at large in a public river or creek, except by grant from the crown. In creating this privilege the crown grants a swan-mark (cygninota), for a *game* of swans, called in law Latin deductus (a pastime, un déduit) cygnorum, sometimes volatus cygnorum. (7 Coke's *Rep.*, 17.) In Scotland the swan is said not to be a royal bird (Erskine's *Instit.*, b. ii., tit. 6); but whilst all proprietors in that country have the right of fowling within their own grounds, swans, unless specially granted, appear to be reserved to the crown. (Stair's *Instit.*, b. ii., t. 3, s. 60; and see Ducange, *Cygnos habendi jus.*) In the reign of Elizabeth, upwards of 900 corporations and individuals had their distinct swan-marks, some of which may be seen in Yarrell's 'British Birds,' vol. iii., 121, &c.

Sometimes, though rarely, the crown, instead of granting a swan-mark, confers the still greater privilege of enjoying the prerogative right (within a certain district) of seizing white swans not marked. Thus the abbot of Abbotsbury in Dorsetshire had a game of wild swans in the æstuary formed by the Isle of Portland and the Chesil Bank. The swannery at Abbotsbury is the largest in the kingdom, which, though formerly considerably more extensive, still numbers many hundreds of these birds, forming an object of considerable attraction and interest to those who visit this part of the south coast: it is now vested in the earl of Ilchester, to whose ancestor it was granted on the dissolution of the monasteries. (7 Co. *Rep.*, 17; Hutchins, *Dorset*, i. 538.)

The privilege of having a swan-mark, or game of swans, is a freehold of inheritance, and may be granted over. But by 22 Edw. IV., c. 6, no person, other than the king's sons, shall have a swan-mark, or game of swans, unless he has freehold lands or tenements of the clear yearly value of five marks (*3l. 6s. 8d.*), on pain of forfeiture of the swans, one moiety to the king, and the other to any qualified person who makes the seizure. In the first year of Richard III. the inhabitants of Crowland in Lincolnshire were exempted from the operation of this act upon their petition setting forth that their town stood 'all in marsh and fen,' and that they had great games of swans, 'by which the greatest part of their relief and living had been sustained.' (6 *Rot. Parl.*, 260.)

The city of Oxford has a game of swans by prescription, though none are now kept. In the sixteenth century (when a state dinner was not complete unless a swan were included in the bill of fare) this game of swans was rented upon an engagement to deliver yearly four fat swans, and to leave six old swans at the end of the term. By the corporation books it also appears that in 1557 barley was provided for the young birds at 14*d.* a bushel, and that tithes were then paid of swans.

Two of the London Companies have games of swans, the Dyers' and the Vintners' Company, and are, with the crown, the principal owners of swans in the Thames. In August, 1841, the queen had 232, the Dyers 105, and the Vintners 100 swans in the river. Formerly the Vintners alone had 500. The swan-mark of the Dyers' Company is a notch, called a 'nick,' on one side of the beak. The swans of the Vintners' Company, being notched or nicked on each side of the beak, are jocularly called 'swans with two *necks*,' a term which has been long used as a sign by one of the large inns in London.

On the first Monday in August in every year the swan-markers of the crown and the two Companies of the city of London go *up* the river for the purpose of inspecting and taking an account of the swans belonging to their respective employers, and marking the young birds. In antient documents this annual expedition is called swan-*upping*, and the persons employed are denominated swan-*uppers*. These are still the designations used amongst the initiated, though popularly corrupted into swan-*hopping* and swan-*hoppers*.

The swan-markers proceed to the different parts of the river frequented by the swans for breeding, and other places where the birds are kept. They pay half-a-crown for each young bird to the fishermen who have made nests for the old birds, and two shillings per week to any person who during the winter has taken care of the swans by sheltering them in ponds or otherwise protecting them from the severity of the weather.

Where, as it sometimes happens, the cob bird (male) of one owner mates with a pen bird (female) belonging to another, the brood are divided between the owners of the parent birds, the odd cygnet (except in Buckinghamshire) being allotted to the owner of the cob.

The young or brown birds, being marked with the marks of their respective owners and pinioned, are put into the river, as are also the white or old swans after the completing of the pinioning of such of them as, on account of their weakness, had in their first year been deprived of one joint only of the wing. If any white swans are found by the king's marker in an open and common river or creek, he seizes them, and the crown mark is put upon them. But swans kept in private waters need not be marked. A subject who has white swans not marked in his private waters may retake them upon fresh pursuit, if they escape therefrom into an open and common river; though it is otherwise if they have gained their natural liberty, and are swimming in open rivers without such pursuit.

The king had formerly a swanherd (magister deductus cygnorum, *Rot. Parl.*, 16 R. II.; 4 *Inst.*, 280) not only on the Thames (6 *Rot. Parl.*, 1 H. VII., fo. 359), but in several other parts of the kingdom (*Abb. Rot. Original.*, 266 b; *Cal. Rot. Pat.*, 174 a). We find persons exercising the office of 'master of the king's swans' (sometimes called the swanship) within the counties of Huntingdon, Cambridge, Northampton, and Lincoln (6 *Rot. Parl.*, 360 b), and at the same time the office of 'supervisor and approver' of all swans being within any mere or water in the first three counties (*Ib.*, 360 b).

Antiently the crown had an extensive swannery annexed to the royal palace or manor of Clarendon in Wiltshire. It had also a swannery in the Isle of Purbeck (Hutchins, *Dorset*, vol. i., pp. 24, 171); and by an entry in the council book of 16th March, 1635, now at the Privy Council Office, it appears that the inhabitants complained that their means of maintaining their families by furnishing the country with swans were lessened by 'comn on shooters in guns.'

Stealing swans marked and pinioned, or unmarked, if kept in a mote, pond, or private river, and reduced to tameness, is felony. (Hale, *Pleas of the Crown*, 68.) Stealing swans not so marked or so kept, or so pursued, is merely a trespass or misdemeanour. (Dalton's *Justice*, c. 156.)

The law is said to have formerly been, that when a swan is stolen in an open and common river, lawfully marked, 'the same swan (if it may be) or another swan shall be hung in a house by the beak, and he who stole it shall in recompense thereof be obliged to give the owner so much wheat that may cover all the swan by putting and turning the wheat on the head of the swan until the head of the swan be covered with the wheat.' (7 Co., *Rep.*, 18 a.)

Under the 11 Henry VII., c. 17, stealing the eggs of swans out of their nests was punished by imprisonment for a year, and a fine at the king's pleasure. But this enactment was superseded by the 1 Jac. I., c. 27, § 2, which declares that every person taking eggs of swans out of their nests, or wilfully breaking or spoiling them, may upon conviction before two justices be committed to gaol for three months, unless he pay to the churchwardens for the use of the poor 20*s.* for every egg; or, after one month of his commitment, become bound, with two sureties in 20*l.* a-piece, never to offend again in like manner. And see *Calend. Rot. Pat.*, 153 b, 165 b, 166 a, 168 a.

The 2 Henry IV., c. 21, which directs that no lord shall give any livery or sign to any knight, esquire, or yeoman, contains a proviso, that the prince may give his honourable livery of the *Swan* to his lords, and to gentlemen his menials. (3 *Rot. Parl.*, 478 a.)

(See Blomfield's *Norfolk;* Kemp's *Losely MSS.; Archæologia*, vol. xvi.; Colonel Hawker.)

SWANEVELT, HERMANN VAN, called the Hermit of Italy, one of the most eminent landscape painters of the Dutch school, was born in 1618 or 1620, at Woerden. It is generally supposed that he was at first a pupil of Gerard Douw; he however went, very young, to Italy, where, having chosen landscape painting as the branch of the art most conformable to his taste, he became a pupil of Claude Lorraine, and soon proved himself worthy of so great a master. He was unremitting in his study of nature, and his retired way of life, which was wholly devoted to his art, caused him to be called 'the hermit,' by which name he was soon generally known. All his works, his paintings, his drawings, and his etchings bear the stamp of a faithful imitation of nature. The scenes which he represents are diversified and picturesque; the perspective, light and shade, the tone of the

sky, are admirable, and expressed with a firmness and decision that indicate the hand of a master. It is said that, in company with Claude, he was fond of observing the effect of the first faint tinge of the morning light on the surfaces of objects, and the changes that gradually take place as the sun rises higher in the heavens, and as he progressively declines from his meridian splendour; effects which are delineated with so much truth and beauty in Claude's four splendid pictures of Morning, Noon, Evening, and Night, formerly in the gallery of Hesse-Cassel, whence they were removed by order of Napoleon to Malmaison, and, after the treaty of Paris, not restored to the elector, but sent by the emperor Alexander to St. Petersburg.

Swanevelt's pictures have the sweetness and tenderness of Claude, but they want his warmth, and are less striking in their effect; but his figures both of men and animals are superior to those of Claude. His paintings are excessively rare, as well as his drawings. Dr. Waagen, in his work on the 'Arts in England,' mentions only a single picture by Swanevelt as having been seen by him. This was at Luton House, in the collection of the Marquis of Bute, of which he says, 'It is a large landscape of extraordinary beauty in the composition, very clear in the colouring, and careful in the execution.' His etchings, 116 in number, have never been surpassed in the choice of the subjects, the judicious distribution of light and shade, the pleasing groups of figures with which they are adorned, and the spirit and perfection of the execution. To appreciate their merit, we must have good impressions, which usually have the master's name on them; for the plates have passed through many unskilful hands, and many can scarcely be recognised. His pictures were so much sought for, even in his life, that they were sold at excessively high prices. The time of his death, which took place at Rome, is rather uncertain; some say it was in 1690, others in 1680: the latter date appears to be the more correct.

(Pilkington; Fuseli; *Conversations Lexicon;* Waagen.)

SWANS, a subfamily of web-footed birds, belonging to the family *Anatidæ*, order *Anseres* of Linnæus.

For a general notion of the position of the subfamily *Cygninæ*, genus *Cygnus*, Meyer, the articles DUCKS, FULIGULINÆ, and GOOSE should be consulted.

In the first of these articles [vol. ix., p. 175] will be found the arrangement proposed by Mr. Vigors.

Mr. Swainson makes the genus *Cygnus* the first of his subfamily *Anserinæ*, with the following character:—

Size large. Base of the bill tumid, fleshy, and naked. Neck remarkably long. Feet short. Hinder toe simple. (*Classification of Birds.*)

The Prince of Canino, in his *Birds of Europe and North America*, arranges the *Anseres* as his fifth order of birds. The *Anatidæ* stand as the first order of the *Anseres*, and comprise the subfamilies *Cygninæ*, *Anserinæ*, *Anatinæ*, *Fuligulinæ*, and *Merginæ*. The *Cygninæ* consist of the single genus *Cygnus*, of which the Prince records *Cygnus Olor*, *Cygnus immutabilis*, *Cygnus musicus*, and *Cygnus Bewickii*, as European species, and *Cygnus Americanus* and *Cygnus Buccinator*, as American species. The *Cygninæ* in the Prince's method are immediately followed by the *Anserinæ*.

The *Anatidæ* form the first family of Mr. G. R. Gray's eighth order, PALMIPEDES, Cuv. The *Cygninæ* compose the fifth subfamily of the *Anatidæ*, and are placed between the *Anserinæ* and the *Anatinæ*. The following genera are arranged under the *Cygninæ*: *Cygnus*, Briss. (*Anas*, Linn.); *Olor*, Wagl. (*Anas*, Linn.); *Chenopis*, Wagl. (*Anas*, Lath.); *Microcygna*, G. R. Gray (*Anas*, Gm., *Bernicla*, Steph., *Cheniscus* (Brooke), Eyton, *Anserella*, Sw.?). The subfamily is placed between the *Anserinæ* and the *Anatinæ*. (*List of the Genera of Birds*, 1st edition.) In the second edition of the same useful work, the *Cygninæ* form the fourth subfamily; the third subfamily of the first edition, *Cereopsinæ*, being cancelled, and the genus *Cereopsis* transferred to the subfamily *Anserinæ*.

Only two true swans are recorded by Linnæus, and those as varieties of *Anas Cygnus*, viz. var. *α*, *Cygnus ferus*, and var. *β*, *Cygnus mansuetus*. Since his time the researches of zoologists have added considerably to the catalogue.

The peculiarities of organization in this subfamily deserving of notice are the great length of the neck, consisting of 23 vertebræ, and the cavity in the sternum for the reception of a considerable portion of the trachea.

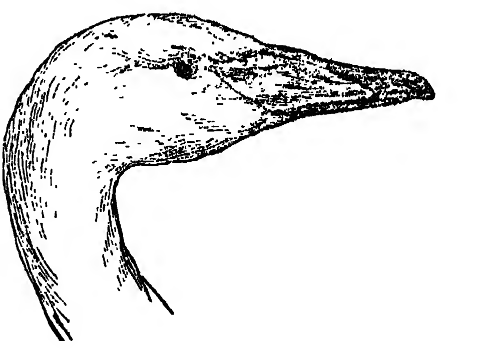
Generic Character of Cygnus.—Beak of equal breadth throughout its length; higher than wide at the base; depressed at the point; both mandibles furnished along the sides with transverse serrated lamellæ. Nostrils oblong, lateral, near the middle of the beak. Neck slender and very long. Legs short, the hind toe small and free. (Yarrell.)

EUROPEAN AND ASIATIC SWANS.

Cygnus ferus, Ray.—*Male.*—Pure white, with occasionally a buff tinge on the top of the head. Bill black and depressed anteriorly, quadrangular at the base and yellow, which tint extends forward along each lateral margin of the upper mandible beyond the aperture of the nostrils, which are black: bare space between the base of that mandible and the eye also yellow, which colours the back part of the lower mandible. Iris brown. Feet black. Length, with neck stretched out, about five feet. Across expanded wings about eight feet.

Female.—Similar to the male, but smaller, and the neck more slender.

Young.—Those that we have seen, when about a week old, have been covered with a grey down above and a whitish down below, with flesh-coloured feet, or rather of a dusky flesh-colour; the bill flesh-coloured, and rather dusky above, anteriorly. Mr. Yarrell states that at ten weeks old the bill is dull flesh-colour, the tip and lateral margins black; the head, neck, and all the upper surface of the body pale ash-brown; the under surface before the legs of a paler brown; the portion behind the legs dull white; the legs, like the bill, of a dusky flesh-colour. This description was taken from young birds in the Garden of the Zoological Society in the middle of August. In the middle of October the same zoologist found the bill black at the end, with a reddish-orange band across the nostrils, and the base and lore pale greenish-white; the general colour pale greyish-brown; a few of the smaller wing-coverts white, mixed with others of a pale buffy-brown, and the legs black. He also observes that the young Hoopers bred in 1839 had almost all their brown feathers at the autumnal moult of 1840, and that before their second winter was passed they were entirely white. (*British Birds.*)



Head of Hooper.

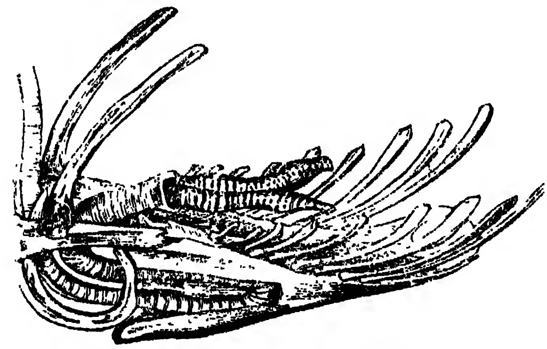
This is the *Cygnus musicus* of Bechstein, and, as there are now more than one wild species well defined, the Prince of Canino and others adopt that specific name, instead of the original *ferus*; but the propriety of this may be doubted. It is the *Cygne Sauvage* of the French; *Cigno* and *Cigno Salvatico* of the Italians; *Singschwan* and *Nordöstliche Singschwan* of the Germans; *Vild Svane* of the Danes; *Hooper*, *Elk*, and *Whistling Swan* of the modern British; and *Alarch gwyllt* of the antient British.

Geographical Distribution.—Northern regions of Europe and Asia, residing in summer within the arctic circle, Iceland, Scandinavia. Winter visiter to the British Islands (where however it has been known to breed in the Shetland and Orkney Islands and in Sutherlandshire), Holland, France, Provence, and Italy, and, according to Mr. Bennett, going as far south as Barbary and Egypt. Eastward it extends as far as Japan. This species is in all probability the swan so much celebrated by the antient poets for its dying song.

Habits, &c.—The note of this wild swan resembles the word 'hoop' uttered several times successively. They fly in a wedgelike figure, uttering this note as they proceed, and when heard from above it is not unmusical. The apparatus for producing these sounds was known to Aldrovandi,

Sir Thomas Browne, Willughby, Ray, Latham, and others. Mr. Yarrell, who has paid so much attention to the tracheæ of birds, has thus well described it:—

'The cylindrical tube of the trachea or windpipe passes down the whole length of the long neck of the bird, in the usual manner, but descends between the two branches of the forked bone called the merrythought, to a level with the keel of the breast-bone or sternum. The keel of the breast-bone is double, and receives between its two plates or sides the tube of the trachea, which, after traversing nearly the whole length of the keel, turns suddenly upon itself, passing forwards, upwards, and again backwards, till it ends in the vertical bone of divarication from whence the two long branchial tubes go off, one to each lobe of the lungs. The depth of the insertion is not so considerable in females or young males.'



Sternum of Hooper with a portion of one side of the keel removed to show the convoluted tube within. (Yarrell.)

The Hooper, like the rest of the Swans, feeds on aquatic plants and insects, can keep the head under water for some time, but never dives. The large nest is constructed on the ground with flags, rushes, leaves, and marshy plants. The eggs, six or seven in number, are whitish tinged with yellowish-green. Length of egg 4 inches, breadth 2¾ inches.

This species breeds in captivity, and may frequently be seen on ornamental pieces of water in a half-domesticated state.

Cygnus Bewickii.—Independent of external characters, the anatomical distinctions pointed out by Mr. Yarrell, who first proposed to separate the species under the name here given, clearly point out the difference between it and the Hooper. 'The principal and most obvious difference,' says Mr. Yarrell, 'is in the trachea. The tube of the windpipe is of equal diameter throughout, and, descending in front of the neck, enters the keel of the sternum, which is hollow, as in the Hooper, traversing the whole length. Having arrived at the end of the keel, the tube, then gradually inclining upwards and outwards, passes into a cavity in the sternum destined to receive it, caused by a separation of the parallel horizontal plates of bone forming the posterior flattened portion of the breast-bone, and producing a convex protuberance on the inner surface. The tube also changing its direction from vertical to horizontal, and reaching within half an inch of the posterior edge, is reflected back after making a considerable curve, till it once more reaches the keel, again transversing which, in a line immediately over the first portion of the tube, it passes out under the arch of the merrythought; where, turning upwards and afterwards backwards, it enters the body of the bird, to be attached to the lungs in the usual manner. This is the state of development in the oldest bird I have yet met with. The degree next in order, or younger, differs in having the horizontal loop of the trachea confined to one side only of the cavity in the sternum, both sides of which cavity are at this time formed, but the loop of the tube is not yet sufficiently elongated to occupy the whole space; and the third in order, from a still younger bird, possesses only the vertical insertion of the fold of the trachea.' Mr. Yarrell adds however that in this last case the cavity in the posterior part of the sternum already exists to a considerable extent.

Bewick's Swan is much smaller than the Hooper, the whole length being from three feet ten inches to four feet two inches.

'Young birds,' says Mr. Yarrell, 'as they appear here in the plumage of their first winter, are greyish brown. At their second winter, when they have acquired the white plumage, the irides are orange; the head and breast strongly marked with rusty red; base of the beak lemon yellow; when older, some continue to exhibit a tinge of rust-colour on the head, after that on the breast has passed off. The adult bird is of a pure unsullied white; the base of the beak orange-yellow; the irides dark; the legs, toes, and membranes black.'

The anterior part of the bill is black, and, in the males, orange-yellow at the base, which is of a lemon-colour in the females.

Geographical Distribution.—North of Europe and America certainly, and of Asia probably. It breeds within the Arctic Circle, and in Iceland in May, according to Temminck, who says that it has been found on the maritime coasts of Picardy. It is an occasional visiter to the British Islands, especially in severe winters.

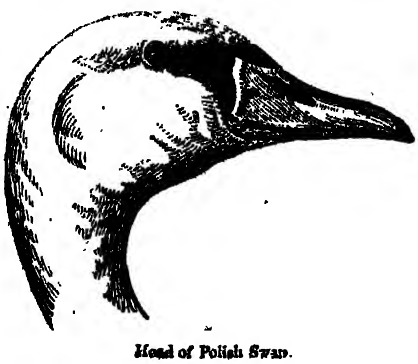
Habits, &c.—The nest, according to Captain Lyon, is constructed of moss-peat, is nearly six feet long, four and three-quarters wide, and two feet high on the outside, with the cavity a foot and a half in diameter. The eggs, six or seven in number, are of a yellowish-brown, according to Temminck; brownish-white slightly clouded with a darker tint, according to Lyon. The call-note of this species is said to be a low-toned whistle, according to Mr. Sinclaire, but this was in confinement. Mr. Blackwall describes their calls in their wild flights as loud, and says that a flock of twenty-nine of them were very clamorous.

The Polish Swan, *Cygnus immutabilis* of Yarrell, is another wild species, and its cygnets, unlike those of the other white swans, are pure white. It has been kept in captivity. Mr. Yarrell states that Lord Derby purchased a pair of these swans and sent them to Knowsley. The female died. The male paired with a Mute Swan, *Cygnus Olor*, and a brood was the result; but the hybrids, though old enough, neither paired among themselves nor with any of the Mute Swans on the same water.

The following is Mr. Yarrell's description of the Polish Swan:—

'In the adult bird the beak is reddish-orange; the nail, lateral margins, nostrils, and base of the upper mandible black; the tubercle, even in an old male, of small size; the irides brown: the head, neck, and the whole of the plumage pure white; legs, toes, and intervening membranes slate-grey. From the point of the beak to the end of the tail, fifty-seven inches. From the carpal joint to the end of the second quill-feather, which is the longest in the wing, twenty-one inches and a half; tarsus four inches; middle toe and nail five inches and three-quarters. Its food and habits

Head of Bewick's Swan.

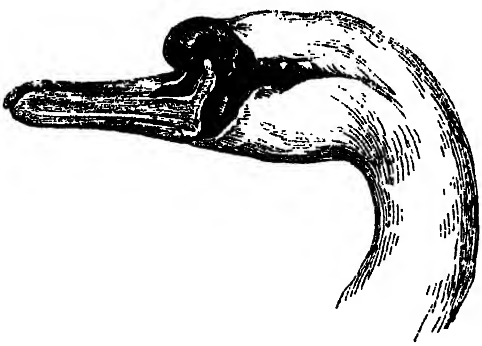


Head of Polish Swan.

closely resemble those of the Mute Swan. The organ of voice appears, from one that I examined, to be like that of the Mute Swan; but Mr. Pelerin has found considerable differences in various parts of the head; the description and measurements were given in a paper published in the 'Magazine of Natural History' for 1839, page 178.'

Mr. Yarrell then extracts Mr. Pelerin's comparative measurements of the crania of adult Mute and Polish Swans, and states that he has verified all his observations.

Cygnus Olor (Genus *Olor*, Wagl.).—Our Mute half-domesticated Swan is too well known to require description. The trachea has none of the complicated structure of that of the Hooper, and is even more simple than that of the Black Swan. The large tubercle, or berry, as the swan-herds term it, at the base of the bill, at once distinguishes this graceful species from its congeners.

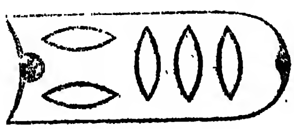


Head of Mute Swan.

It is the *Cygne* of the French; *Cigno* and *Cigno Reale* of the Italians; *Schwan* and *Höcker Schwan* of the Germans; *Tam Svane* of the Danes; *Tame Swan* or *Mute Swan* of the modern British; and *Alarch* of the antient British.

This elegant bird is said to exist in a wild state in Russia and Siberia. The Prince of Canino, in his *Specchio Comparativo*, speaks of it as occurring in the neighbourhood of Rome (' Raro Avventizio d'inverno'); and in his 'Birds of Europe and North America' he gives North-Eastern Europe as the locality. The Polish Swan above noticed should not be forgotten in assigning these northern localities to our Tame Swan, and very probably was not by the skilful ornithologists who have noted these localities. Temminck says, 'Habite en état sauvage les grandes mers de l'interieur, surtout vers les contrées orientales de l'Europe.'

In the Thames, at present, the greatest number of swans belong to the Queen, and the companies of vintners and dyers own the next largest proportion; but the birds are far less numerous than they used to be. The swan-marks are made upon the upper mandible with a knife or other sharp instrument. The swan-hopping or upping, that is, the catching and taking up the swans to mark the cygnets, and renew that on the old birds if obliterated, in the presence of the royal swanherd's man, is still continued by the companies above mentioned. Below is the royal swan-mark used in the three last reigns and the present, from the cut given by Mr. Yarrell, in whose interesting *British Birds* much curious information on this subject, together with no less than sixteen swan-marks, will be found.



Royal Swan-mark. (Yarrell.)

American Swans.

Dr. Richardson (*Fauna Boreali-Americana*) records only two American swans, *Cygni Buccinator* and *Bewickii*. The Prince of Canino, in his 'Specchio Comparativo,' gave one, *Anas Cygnus* (meaning, apparently, the hooper). Nuttall notices three: 1st, the wild or whistling swan, *Cygnus ferus* of Ray; 2nd, the trumpeter swan, *Cygnus Buccinator*: and 3rd, *Cygnus Bewickii*. The Prince, in his 'Birds of Europe and America,' records two species, *Cygnus Americanus*, Sharpl. (*Cygnus musicus*, Bonap.); and *Cygnus Buccinator*; but he does not record *Cygnus Bewickii* as an American species. Nuttall declares that in the winter of 1810 he saw two individuals of *Cygnus ferus* (*C. musicus*, Bechst. and Bonap.) in a state of domestication near St. Louis (Missouri), which were obtained, with several others at the same time, in consequence of the extreme cold. The Prince of Canino evidently considers his *C. musicus*, which he gives as a synonym of *C. Americanus*, a different species from *Cygnus Bewickii*, which last stands opposite to *C. Americanus* in the European column.

We select *Cygnus Buccinator*, which, according to Dr. Richardson, is the most common swan in the fur-countries, and to which the bulk of the swan-skins imported by the Hudson's Bay Company belong.

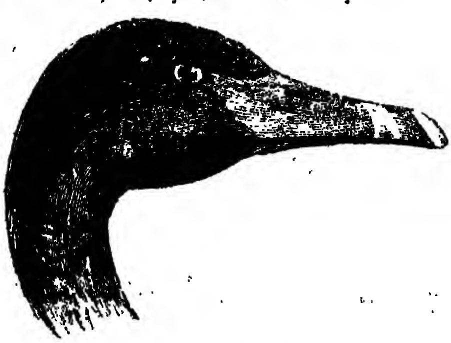
Description of a specimen killed at Hudson's Bay, and now in the Hud. Bay Museum. *Colour* white, the forehead alone tinged with reddish orange. Bill, cere, and legs entirely black. *Form*.—Bill nearly resembling that of *C. ferus* in form, though longer and rather more depressed. Wings: third quill the longest. Tail consisting of twenty-four feathers: a specimen in the Zoological Museum has the crown and cheeks bright chesnut. Total length 70 inches. (Richardson.)

Dr. Richardson remarks that it breeds as far south as 61° lat., but principally within the Arctic Circle, and that in its migrations it generally precedes the geese. He observes that *Cygnus Bewickii* makes its appearance amongst the latest of the migratory birds; while *C. Buccinator* is the earliest, with the exception of the eagles. He states that a fold of its windpipe enters a protuberance on the dorsal or interior aspect of the sternum at its upper part, which is wanting both in *Cygnus ferus* and *C. Bewickii*; in other respects, he adds, the windpipe is distributed through the sternum nearly as in the latter of these species. In the Supplement to Sir Edward Parry's first voyage, *Anas Cygnus*, *Wild Swan*, with references which leave no doubt that the hooper was meant, is noted as breeding on the North Georgian Islands; but *Cygnus Bewickii* had not then been distinguished.

Australian Swans.

Cygnus atratus (Genus *Chenopis*, Wagl.).—This, the *Anas Plutonia* of Shaw, has now become so common in our menageries, where it breeds freely, as not to justify the occupation of space with more than a cut of its head and of the course of its trachea, which is not unlike that of the mute swan.

Description.—Black, except the primary and a few of the secondary quills, which are white. Bill bright-red above, and, sometimes, with a slight tubercle at the base, which the female wants. The anterior part of the upper mandible is crossed by a whitish band, and the under one is greyish-white. Legs and feet dull ash-colour. Size less than that of the mute swan and hooper. Irides red. Young, when about a fortnight old, covered with dusky-grey down above, lighter beneath; bill, eyes, and feet dusky-black.



Head of Black Swan.

Mr. Yarrell observes that the structure of the trachea is intermediate between that of the hooper and the common mute swan. It 'quits the neck at the bottom, and descends to the centre circular portion of the furcula, to which it is firmly bound by a tough membrane: the remaining portion then rises over the front of the breast-bone between the clavicles, and passes backward to the lungs, the last portion of the tube immediately preceding the bone of divarication being flattened horizontally. The form of an trachea in our common swan, in which it follows the

internal fire; there was violent fever, pain in the head and limbs, prostration of strength, hurried breathing, a small frequent pulse, nausea, great thirst, delirium, and excessive restlessness. Shortly after the appearance of these symptoms a profuse clammy fetid perspiration broke out over the whole body; the thirst became more intolerable, and the patients either died in a state of delirium or coma, or recovered as suddenly as they had been first attacked. Such was the rapidity with which this disease ran its course, that its victims were sometimes carried off in three or four hours, or even before the sweating stage had set in; and all danger was considered to be at an end if the patient survived the first twenty-four hours. The profuse sweating which characterised the disease was looked upon as an effort of nature to get rid of some morbific matter from the system, and the early appearance of this stage was therefore regarded as a favourable circumstance. Accordingly, when persons were attacked, it was usual to put them immediately to bed, without even removing their clothes, to enjoin absolute quietude, and to encourage the outbreak of the perspiration by heating the room, covering them well up from the air, and giving them mild cordials. If the sweating stage were tardy in appearing under the influence of these means, friction was had recourse to; and if the patient were at the same time very feeble, drinks of a more stimulating quality were administered, such as undiluted wine, or spirituous infusions of aromatic herbs: fumigations with storax, laurel, or juniper berries were also employed. These remedies were persisted in till the sweating was fully established. After twelve or fifteen hours the coverings of the patient were diminished, the apartment was made cooler, and the air was impregnated with the vapour of vinegar; sleeping was not allowed at this stage of the complaint unless the pulse was strong, it having been observed that those who indulged in this propensity seldom woke again. At the end of twenty-four hours the linen was all changed, nourishing food was gradually administered; and on the second or third day, if the weather was propitious, the patients were allowed to go out. This mode of treatment, which is so different from that pursued in the present day in analogous diseases, does not appear to have been adopted simply with the view of hastening the accession of the sweating stage, but from the experience of the injurious influence of cold in this disease, several fatal cases having been attributed to the mere exposure of the patient's arms to the air while in bed.

The sweating-sickness is said to have made its first appearance in this country in the army of the earl of Richmond, on his landing at Milford Haven in the year 1485. On the 21st of September of the same year it reached London, where it raged till the latter end of October. It reappeared in this country during the summers of 1506, 1517, 1528, and 1551. From 1525 to 1530 it visited Holland, Germany, Denmark, Sweden, Poland, and parts of Russia; and Forestus informs us (lib. vi., obs. 8) that it broke out in Amsterdam on the 27th of September, 1529, where it raged but four days, sparing only old people and children, and attacking above one hundred persons a day. With respect to the mortality of this disease accounts are somewhat vague. Bacon informs us that in the first epidemic the patients recovered if they were attended to in time, but that many died before a remedy was discovered. The epidemic of 1517 appears to have been particularly fatal, frequently destroying its victims in two or three hours, and in some places carrying off one-third, and even one-half of the inhabitants: that of 1528 was also very fatal, but was remarkable for its short duration in each place: Hamburg lost 2000 of its inhabitants, and Copenhagen 400 by this epidemic. The last outbreak of this disease in England happened at Shrewsbury in the year 1551, and was extremely fatal, sparing neither age nor sex: it raged from April to September, becoming milder in character towards its termination.

A remarkable feature of the sweating-sickness, if we are to credit the accounts of those who have written upon it, was its partiality for Englishmen: hence the name of Sudor Anglicus. It is affirmed that foreigners residing in England escaped the infection, while Englishmen who fled abroad for safety were attacked just the same; and in confirmation of this, it is asserted that Calais, which was in the hands of the English during the epidemic of 1517, suffered dreadfully, while all the rest of France, and even Scotland and Ireland, escaped. However true this may be as regards the two first epidemics, it certainly is not so of that which broke out in 1528, and which, we have already seen, visited nearly all the principal places on the Continent. Such is a brief sketch of this singular malady, the origin and causes of which are still involved in considerable mystery. Bacon speaks of it as a terrible and unknown disease, that had its origin neither in the blood nor in the humours; a surprise of nature, rather than obstinate to remedies. Drs. Caius and Mead believed it to be a modification of the plague; and Dr. Mead says that it was imported into this country from France, whither it had been conveyed in 1480, from the island of Rhodes, at that time besieged by the Turks. Caius affirms that the two epidemics of 1517 and 1528 were brought to England from Florence and Naples, at which places the plague was then raging, and that it was the same disease, only modified by climate. Dr. Cullen thought it a variety of typhus; and Dr. Willan suggested that it might have been produced by some disease in the wheat at those periods at which it prevailed, just as the Asiatic or malignant cholera has been attributed to the eating of bad rice. Opinions are not less at variance respecting the antiquity of this disease, and its identity with that which still prevails on some parts of the Continent, to which the term of 'La Suette' has been applied. M. Rayer, without giving a decided opinion on the subject, admits that although there are noteable differences between the two diseases in point of duration and gravity, yet there is an incontestible analogy between them. It is perhaps impossible at this distance of time to decide the question: we shall therefore conclude this article by referring those who may feel an interest in the subject to M. Rayer's *Histoire de l'Epidémie de la Suette-Miliare qui a régné en* 1821, *dans les Départemens de l'Oise et de Seine-et-Oise*, 8vo., Paris, 1822.

SWEDBERG, JESPER, a Swedish prelate and theological writer, was born on the 28th of August, 1653, at Sweden, near Fahlun, the estate of his parents, Daniel Isaacson and Anne Bullernesia, who were members of a respectable family among the miners of Stora Kopparberg. Swedberg took his degree at Upsala in 1682, was appointed chaplain to the Royal Guards in 1684, chaplain to the court in 1685, and was promoted to the living of Vingäker in 1690. He was called to Upsala as professor of theology in 1692, and made primate and provost of the cathedral of that place in 1694. Charles XI. appointed him over the Swedish communities in Pennsylvania (America): and in 1702 Charles XII. created him bishop of Skara in Westrogothia. In 1705 he became doctor of theology at Upsala; and in the same year Charles XII. placed him over the Swedish communities in London. He procured for the city of Skara a privileged press, to which he gave employment by his numerous writings. In 1712 the episcopal palace was destroyed by fire, and the bishop lost his library and many MSS. In 1719 the whole town of Skara was burnt, but the gymnasium and cathedral were rebuilt in five years through his exertions. On the 3rd of May, 1719, his family was ennobled by the name of Swedenborg. In 1730 another fire deprived him of nearly the whole of his property. He was vigorous and active to the end of his life, which terminated on the 26th of July, 1735. He died at the age of eighty-two, and was buried in the convent-church of Varnhem. Bishop Swedberg was three times married: first, to Sarah Behm [SWEDENBORG, EMANUEL]; secondly, to Sarah Berghia; and thirdly, to Christina Urrhusia: he had seven children, four daughters and three sons, of whom the eldest was Emanuel Swedenborg. (Gezelius, *Försök til et Biographiskt Lexicon*, 8vo., Stockholm, 1778-80.)

The bishop's writings are voluminous, and they are not confined to theology, but take in a wide range of subjects. He was one of the earliest writers on Swedish orthography: his book on this subject drew down on him the censure of one Urban Hjaerne, who, in a violent pamphlet that he put forth in the form of dialogue, accused the worthy bishop of πολυπραγμοσύνη (in fact, of being a busybody in literature). A very complete list of Swedberg's extensive works may be seen in the *Catalog. Libr. Impr. Biblioth. Reg. Acad. Upsal.*, 3 tom., 4to., Upsal., 1814.

Many particulars of his history are given in Lagerbring's *Sammandrag af Swea-Rikes Historia*, 8vo., Stockholm, 1778-80; and a good biography of him is prefixed to Dr. Tafel's *Swedenborg's Leben*, Tübingen, 1841, pp. 1-43. He left behind him in MS. an Autobiography in 1002 folio sheets; a copy of which he is said to have given to each of his children. The title of this document (which is written in Swedish, and still extant in Sweden) may be translated

as follows: 'Manuscript: The Life of Jesper Swedberg, Bishop of Skara, written in detail by himself, in accordance with the truth; in order to remind him of the goodness of God and of his wonderful Providence; and to give to his children and posterity necessary instruction for passing through life happily; whereto may God grant them his grace:' Brunsbo, Nov. 15, 1728. (Warmholtz, *Bibliotheca Sueo-Gothica*, 8vo., Upsal, 1782, et seqq.)

'This Jesper Swedberg,' says the Rev. Nicholas Collin, rector of the Swedish church in Philadelphia, 'was well qualified for one of the principal bishoprics in Sweden. His plain manner of living enforced his zealous remonstrances against pomp and luxury, which if not very common, yet were the more pernicious in that distressful period, when Sweden had lost her veteran armies, and depended in a great measure on lads and old men for opposing the combined forces of Russia, Poland, and Denmark; and was moreover consuming by famine and pestilence. The bishop's influence animated that patriotic fortitude which sustained such burdens and misery, and blazed in so many battles! His popularity gave particular energy to some public regulations, which lessened the havoc of pestilence: a judicious and pathetic address to the people convinced them that interring in new grounds was a necessary measure, though a temporary sacrifice of their laudable attachment to the consecrated ground in which the earthly remains of their beloved relatives reposed. The bishop was for many years superintendent of the Swedish mission about Delaware. His letters to the clergy and to the congregations, which are preserved in its records, bear witness to his zeal, kindness, and love of science. He requested of the missionaries to inform him of any extraordinary events in the moral and physical world which happened in these parts of America.'

SWEDEN, a country in Europe, which occupies the eastern and larger portion of the Scandinavian peninsula, and is situated between 55° 20′ and 69° N. lat., and between 11° and 27° E. long. About one-sixth of the country lies within the Polar Circle. On the east of Sweden, from its southern extremity to 66° N. lat., extends the Baltic and the Gulf of Bothnia, which divide it from Russia. A little south of 66° the two countries are contiguous, and continue so to the most northern point of Sweden, and in this part the boundary runs up along the Tornea Elf to its confluence with the river Muonio, which takes place near 67° 10′ N. lat. Farther north the course of the Muonio constitutes the boundary as far as the confluence of its two upper branches, the Lätäs Eno and the Köngämä, from which point it follows the course of the last-mentioned river to its source in the small lake of Koltejaur, which is on the boundary of Norway. On the west of Sweden is Norway. The boundary between these two countries runs along the range of the Kiolen Mountains, and as far south as 65° it follows the watershed, though not the most elevated part of the range. In these parts the watershed, and consequently the boundary, runs in a very irregular line. Between 65° and 64° N. lat. Norway extends to the east of the watershed: and some branches of the Angerman Elfven and Indals Elfven, which fall into the Gulf of Bothnia, rise within Norway. South of 64° N. lat. the boundary returns to the watershed, and follows it to Mount Sylfyellën (63° N. lat.), whence it runs nearly in a straight line southward along a high ridge to Mount Heryehogna (61° 42′ N. lat.). From this mountain it continues in a general southern direction, but in a more irregular line, which is not marked by any natural feature, to its southern extremity a little south of 59° N. lat., when it turns west, and soon reaches a very long and narrow lake called Bullaren, which extends northward, and is connected with the Cattegat by a sound called Swinesund. The boundary lies along the lake and sound. The Skagerack washes the western coast of Sweden between 59° and 58°, and the Cattegat between 58° and 56°. North of 56° the strait called Oresund, or simply the Sound, begins, which extends to the most southern extremity of Sweden, and separates it from the Danish island of Zealand. South of Sweden is the western part of the Baltic, which separates it from Germany. [BALTIC, vol. iii., p. 347.]

The length of this country from south to north is somewhat more than 900 miles: its width between 58° and 68° N. lat. varies from 150 to 200 miles; but south of 58° and north of 68° it is not so wide. Its area, according to the estimate of Forsell, is 3868 Swedish square miles, equal to about 170,000 English square miles: it consequently covers a surface larger than that of the British Islands by 58,000 square miles, or by more than half their area, and falls short of the area of France only by about 34,000 square miles.

Coast.—The coast of Sweden is somewhat more than 1400 miles, exclusive of the deep inlets. The coast along the Skagerack, Cattegat, and Sound is near 300 miles: the remainder is washed by the Baltic. Along the most northern part of the Gulf of Bothnia, or that which is called by the Swedes Botten Viken [BOTHNIA, GULF], the coast is low, and consists of sandy alluvial matter brought down by the numerous rivers which fall into this part of the Baltic. The islands which line this coast in all its extent are of the same character. The coast begins to rise as it approaches the Quarken, or strait which connects the Botten Viken with the Botten Hafvet or Sea of Bothnia, and the islands which lie across the strait are rocky. South of the Quarken, as far as the town of Gefle (near 60° 40′ N. lat.), the coast presents an alternation of low and moderately elevated shores, in some places rocky, but in others sandy and composed of alluvium. The islands which line this tract of coast are less numerous than farther north, but larger, and they resemble the neighbouring coast, many of them being low and sandy, while others are undulating, and contain low rocky hills. A few of the larger islands, especially in the vicinity of the Angerman Elfven, are partly rocky and partly composed of alluvium. The semicircular projection of the Swedish coast between Gefle on the north (60° 40′ N. lat.), and the Bräviken near Norrköping on the south (58° 35′ N. lat.), has a rocky shore, indented by numerous inlets, which are generally small, with the exception of that which unites Lake Mälaren with the sea. In consequence of these inlets, this coast consists of a succession of small peninsulas. Though extremely rocky, the coast in general is of moderate elevation: in a few places it may rise to 100 feet. The islands, which are very numerous along the whole coast, but especially to the south of Alands Haf (the Sea of Aland), consist all of rocks, but the greater part of them are only a few feet above the sea. These rocky islands and islets are called *skars*, and many of them are surrounded by sand-banks. South of the small bay called Bräviken, as far as the parallel of the northern extremity of the island of Oland (57° 22′ N. lat.), the coast is partly rocky and somewhat elevated, and partly low and sandy. It is likewise intersected by many inlets, all of which run from east-south-east to west-north-west, so as to give to this part of the coast nearly the appearance of a saw. The rocky islands and cliffs which line it are still more numerous than farther north, and render the access to it very difficult. The west coast of the Strait of Calmar, which divides the island of Oland from the mainland of Sweden, runs in a less broken line, though there are a few indentations in its northern part, but these inlets are short. The shores are generally low. The islands in this strait are comparatively few; and south of Calmar they disappear almost entirely. The Strait of Calmar terminates on the south with Cape Tornhamnsudde or Torrumudde, a low rocky point east of Carlscrona, at which the coast, which up to this point extended nearly due north and south, suddenly turns to the west. This is the most broken rocky and elevated part of the coast of Sweden, and it extends to a few miles west of Carlshamn. Nearly the whole of this coast consists of rocks, sometimes rising 50 feet high with a steep ascent: but between the projecting masses, and especially at the mouths of the small rivers, it sinks nearly to the level of the sea; and such places generally form good harbours and anchorages, being protected from the wind and sea by the numerous islands which line the coast. The largest of these islands are at a short distance from Cape Torrumudde, and form the harbour of Carlscrona. [CARLSCRONA.] The rocky elevated coast terminates at the peninsula of Sölvetsborg; the shores of the peninsula of Scania, which forms the most southern part of Sweden, being low, sandy, and free from islands and rocks, but in a few places lined with sand-banks. Cape Kullen, which forms the northern entrance of the Sound on the east, is of moderate elevation, but north of it the coast sinks down nearly to the level of the sea, and continues so to Warberg, up to which place no islands or rocks occur. The coast rises a little north of Warberg, and the rocky islands reappear and increase in number as we proceed northwards: the coast also gradually rises higher, though the elevation never exceeds 30 feet. The coast is very rocky, and intersected by several large inlets, especially north of Götheborg, where

the arms of the sea run up to Uddevalla, and separate from the mainland two large islands, Työrn and Orust, which are rather hilly. The other islands are only rocky cliffs of small extent and moderate elevation; and as we approach the boundary of Norway several of them consist of sand and other alluvial matter.

General Description of the Surface.—In that part of Sweden which lies north of 62° N. lat., the country rises continually from the Gulf of Bothnia to the boundary of Norway. South of that parallel the slopes extend in a different direction. Between 62° and 59° the country slopes to the south, and attains its lowest level at the place where the three great lakes of Wenern, Hielmarn, and Mälaren nearly intersect the country: south of these lakes the country rises again, and from 58° to 57° 10′ it constitutes an elevated table-land bounded by slopes. This table-land is connected with the mountain-region north of 62° by a low narrow ridge, which runs nearly due north of it between 14° and 15° E. long. as far north as 60° N. lat., and afterwards declines to the north-west. This ridge constitutes the water-shed between 58° and 62°.

The most elevated part of Sweden lies along the boundary-line of Norway, and is called the Kiölen Mountains, which range extends as far south as 64° N. lat. The mountainous country continues farther south to 61° N. lat., but this southern portion is a part of what is called Norska Fiellen, or the mountains of Norway. A more detailed description of both ranges is given under NORSKA FIELLEN, vol. xvi., p. 283.

1. The *Northern* part of the mountain-region of Sweden, or that which extends from the banks of the rivers Muonio and Tornea to 64° N. lat., has a great uniformity of surface. The western districts, being occupied by the most elevated portion of the Kiölen range, contains very high mountains, and a considerable tract surrounding Mount Sulitelma is always covered with snow. Forsell calculates that about 720 square miles of the area of Sweden are covered with perpetual snow and ice. Probably 600 of these 720 square miles lie within this region, in the vicinity of the Sulitelma, and of the summits which stand south and north of that mountain. The lowest parts of the highest portion of the range are probably 4000 feet above the sea-level. From these parts the country slopes towards the Gulf of Bothnia; but the descent is not regular, being more rapid near the range, and more gentle towards the sea. The whole distance between the crest of the range and the gulf is rather more than 200 miles. About 40 miles from the crest the whole region has descended to about 2000 feet. In this highest region all the mountains rise above the level on which trees grow, and it is only in the valleys enclosed by them that some diminutive firs and pines are found. The greater part of these valleys are filled with lakes or swamps. This region is not quite uninhabited, but only a few poor families subsist here on the fish (*Salmo alpinus*) which they take in the lakes, and on their cattle.. Below this mountain-region extends the elevated region, in which the country descends from the general level of 2000 feet to that of 800 feet above the sea-level. The width of this tract is about 60 miles, being equal to once and a half the breadth of the mountain-region. The numerous ridges which branch off from the principal range of the Kiölen Mountains within the mountain-region at right angles traverse the whole width of this tract, and their summits are generally above the line of vegetation, or at least of trees, being 3000 feet high; but the mountains occupy a much smaller surface, and the valleys are several miles wide in many places, but nearly all of them are occupied either entirely or principally by alpine lakes. These lakes are frequently of great extent, 30 or 40 miles long, and from 3 to 5 miles wide. One of them, the Horn Afvan, from which the Skelleftea Elf issues, occupies the whole width of this tract, and is more than 60 miles long, and in some places 10 wide. The greater part of the low ground in the valleys is always under water, and the remainder is inundated twice in the year; in the beginning of June, when the snow on the lower mountains melts, and at the end of July, when the long days produce the same effect on the higher part of the range, and consequently no part of this tract is cultivable. These inundations, especially those in July, are exceedingly favourable to the growth of grass, and the inhabitants are thus enabled to maintain a great number of cattle: they also take a great quantity of fish in the lakes, as the Salmo alpinus, the Salmo thymaleus, and the Salmo lavaretus. This higher tract contains some good forests, but their situation, and still more the rapidity of the rivers, which do not admit either navigation or the floating of wood, render them quite useless, except as fire-wood for the use of the inhabitants. Nearer the sea is the lower region, the general level of which sinks from 800 to 300 feet. It is wider than the elevated region, measuring from east to west about 70 miles. The ridges which traverse the whole breadth of the elevated region extend to this region, and may even be said to cross it; but they sink into hills, being, with few exceptions, hardly more than 500 feet above the general level. They are generally wooded to their summits. These hills are not usually steep, and there are small level tracts between them which are dry; but only a small surface is cultivated, owing to the severity of the climate and the poverty of the soil. Potatoes and cabbages, and a little barley and rye, are grown. The inhabitants live mainly on the produce of their cattle. The lakes in this tract are few, and most of them hardly larger than ponds. The fir and pine cover the greater part of the country, and pitch and tar are made from them. The best portion of this lower tract is in the northern districts, where there is a large plain on both sides of the Calix Elf, which extends eastward to the banks of the Tornea Elf. This plain has rich pastures. Between this lower tract and the Gulf of Bothnia extends the lowest region, the average width of which is about 30 miles; and its general level descends gradually from about 300 feet to the low shores of the gulf. The hills which cross the lower region cease as we approach this tract, and enter it only in a few places, except south of the Skelleftea Elf, where the country is hilly nearly to the shores of the sea. The surface of the remainder of this tract rises and falls in gentle slopes, with extensive flats between them. The fertility of the soil is never above mediocrity, with the exception of the plain between the Tornea and Lulea Elf, which produces fine grass. That portion which lies between the Lulea Elf and the Skelleftea Elf is sterile. The tract south of the Skelleftea Elf is much better cultivated, but the fertile ground occupies a very small portion even of this tract: a little rye and oats, and a somewhat greater quantity of barley, are grown. The cultivation of potatoes has lately increased. The tracts used as pasture-ground and meadows are more extensive. Tar is made from the pine-trees. Forsell gives the following account of the Läns of Pitea and Umea, which comprehend nearly the whole of this region. The whole contains an area of 62,496 square miles, being about 4000 square miles larger than England, including Wales, and about 1000 square miles larger than the state of Georgia in North America. Of this area about one-fifth, or, more exactly, 12,499 square miles, are within the range of the Kiölen Mountains; about three-tenths, or 19,109 square miles, are in the elevated region; about seven-twentieth parts, or 21,333 square miles, are in the lower region; and only three-twentieth parts, or 9555 square miles, in the more level country on the shores of the gulf. The surface of the lakes and swamps occupies about one-tenth, or 6250 square miles.—All the cultivated tracts do not exceed 66 square miles, or about one-third of the smallest county in England, Rutlandshire. The meadows occupy about 390 square miles, and all the remainder is either covered with forests or a useless waste. More particulars of this region are given under BOTHNIA.

2. The *Central* portion of the mountain-region, or that which lies between 64° and 62° N. lat., though in some respects it resembles the northern portion, is distinguished by some peculiar features. The average width of Sweden in this part does not exceed 170 miles. The highest part of this region, situated within the Kiölen Mountains, is much narrower, and never exceeds 30 miles in breadth, being usually 20 miles wide, and in some parts even less. Only a few summits are always covered with snow, among which the most elevated is the Sylfiallen, or Sylfiellen, which is 5860 feet above the sea-level. The rivers which originate in this region run only in ravines, and the whole tract is entirely uninhabited, and only visited in summer by a few Laplanders, who find pasture for their reindeer on the declivities of the Sylfiellen and the adjacent mountains. The country adjacent to this mountainous tract forms a kind of table-land, extending about 80 miles in every direction. In the lowest part of this table-land there is the Great Lake, or Storsiön, whose surface is 978 feet above the sea-level: it is 40 miles long from north to south, and in some parts

12 miles wide. The river which issues from the north-east side of the lake is the principal feeder of the Indals Elf. [ANGERMANLAND, vol. ii., p. 18.] This table-land forms a basin, being enclosed by higher land, which is not much more elevated on the east, but rises to a considerable height on the north and south. On the south the table-land is divided by a continuous range of very high ground from the upper valley of the river Ljungan. From the Kiölen range, west of the basin, a branch advances into the basin for a few miles, and then terminates abruptly with the high summit of Mount Areskutan, which is 4716 feet above the sea-level: its declivities afford pasture to the reindeer in summer. The surface of the table-land, which may be called the table-land of Jemtland (Yemtland), may be considered as somewhat more than 1000 feet above the sea. It is very much broken, and interspersed with steep rocks and swamps. Besides the Great Lake there are ten or twelve others, each of them from 10 to 15 miles long, and more than a mile wide. In spite of the great elevation of the country, agriculture is carried on to some extent. Wheat does not succeed, but barley and rye and oats are grown. Several kinds of vegetables, especially potatoes and peas, grow very well. The soil however is stony, and far from being fertile; and towards the end of August the crops are sometimes destroyed by frost. At that season, when a north wind blows with a clear sky, the inhabitants light fires on the north side of their fields, to protect their crops against the destructive effects of the wind, which always brings frost. The pastures being extensive, and many tracts covered with fine grass, the domestic animals are rather numerous, especially cattle, sheep, and goats: there is also a due proportion of horses and hogs. South of the table-land of Jemtland are the upper valleys of the river Ljungan and Ljusnan: that of the latter is called the valley of Herjedalen (Herjedalen), and formed a separate province in the antient division of the country. These two valleys are of considerable width, and though interspersed with hills, they contain level tracts which are cultivated. But these valleys are tracts much more elevated than the table-land, that of Herjedalen being 1200 feet above the sea, in the eastern districts, and rising to above 1800 feet. Near the Kiölen range the crops very frequently fail, and the inhabitants are obliged to mix the inner bark of the pine-tree with their bread. This is also sometimes done on the table-land, but not so frequently as in these valleys, which are the most elevated part of Sweden in which agriculture is carried on.

From the high ground which forms the eastern border of the table-land of Jemtland, and which may be about 1200 feet above the sea-level, the country descends in a regular slope towards the sea, and at the distance of about 30 miles from it, sinks to 300 feet. There are no considerable hills on this slope, but the rivers which cross it run in narrow valleys considerably depressed below the general level, in which they frequently expand in long narrow lakes, and usually form rapids and cataracts. In this tract agriculture is very limited, for the valleys alone can be cultivated; but the higher grounds contain good pasture and support cattle of various kinds. The remainder of the region, extending about 40 miles west and east, and reaching to the shore of the Gulf of Bothnia, is almost entirely occupied with isolated hills or short ranges; they have generally steep declivities, and some of them rise nearly 1000 feet above the sea. Between them are valleys or level grounds of small extent, which are in some places more than a hundred feet deep, and the lowest part of which is occupied by a winding river, or by a small lake, on the banks of which there are meadows alternating with woods. The slopes of the hills, and generally their summits also, are clothed with trees. This tract contains a much larger portion of cultivated ground than any of those which have been described. Wheat however does not succeed, except in a few sheltered places. Barley is very extensively cultivated, but rye and oats are very little. Potatoes and peas are grown to some extent. But the rearing of domestic animals constitutes the principal occupation of the inhabitants. The number of black cattle and sheep is proportionally great, and that of goats considerable, but horses and hogs are few in number. As a great part of this tract is covered with trees, many of which are fine timber, and as they are at no great distance from the sea, a considerable quantity of timber is exported: a little tar is also made.

According to Forsell, this central portion of the mountain-region covers 28,169 square miles, and is nearly equal to half the area of England without Wales. The mountain-tract within the Kiölen range is calculated to occupy 4687 square miles; and the table-land of Jemtland, with the adjacent ridges and valleys, covers very nearly half the region, or 14,825 square miles. The tract intervening between this table-land and the hilly tract along the coast contains less than one-sixth of its surface, or 4209 square miles, and the hilly tract itself somewhat more than one-sixth, or 4972 square miles. A little more than 85 square miles are under cultivation, and 454 square miles are meadows and good pasture-grounds.

3. The *Southern* part of the mountain-region lies south of 62° N. lat. Its southern boundary would be tolerably well marked by a line drawn from the great bend of the river Glommen in Norway at Kongsvinger, in a north-east direction to the most southern bay of Lake Siljan (Silyan), near 60° 45′ N. lat., and hence continued to the town of Söderhamn, on the Gulf of Bothnia. Near the boundary-line of Norway this southern part extends rather more than 110 miles from north to south, but in proceeding east it grows gradually narrower, until, on reaching the shores of the gulf, it does not much exceed 50 miles. From west to east it extends nearly 140 miles. The area of this region is about 13,222 square miles, or somewhat more than double that of Yorkshire. That part of this region which may properly be called mountainous is not extensive. It does not constitute a part of the Kiölen range, but must rather be considered as an appendage of the Norrska Fiellen. From Mount Sylfiellen, which stands near the eastern termination of that extensive mountain-system, numerous ridges issue in all directions, so that this mountain properly constitutes a mountain-knot. To the east run three ridges enclosing the upper valleys of the rivers Ljungan and Ljusnan, and towards the south those which divide the branches of the Dal river, the Oster and Wester Dal Elfven, from each other, and the latter from the Klar Elfven, whilst the most western ridge separates the Klar Elfven from the Glommen Elf. These three last-mentioned ridges are of considerable width, and lie close to one another, having between them only narrow and high valleys, and accordingly they constitute a mountain-region of considerable extent, which projects from the Norrska Fiellen between the mining town of Roraas and Mount Sylfiellen southward, and divides the lower country of Osterdalen on the Glommen in Norway from that which extends over the middle districts of Dalecarlia, or Dalarne. The width of this mountain-region from east to west is about 70 miles, and its length from Mount Sylfiellen (63° N. lat.) to near 61° N. lat., about 100 miles. The most elevated part of this region surrounds Lake Fämund in Norway, where several summits attain the snow-line, as the Tronfiellet (5619 feet), the Sölenfiellet (5842 feet), and some others. The general level of this region, as far south as 61° 30′, is 2000 feet above the sea; but south of that line it lowers rapidly, so that at its southern extremity, near 61° N. lat., it has sunk to nearly 800 feet above the sea-level. The narrow valleys of this tract are too elevated to be cultivated, and are only inhabited by a few families who cut the wood in the fine pine-forests, with which the lower parts of the mountains are clothed. About one-half of this mountain-region belongs to Norway.

That elevated ridge which separates the valley of the Wester Dalelfven from that of the Klarelfven, preserves a considerable elevation south of 61° N. lat., running south-south-east until it has passed 60° N. lat., when it turns to the south. Near the mountain-region its general elevation is more than 1500 feet above the sea; but south of 60° 30′ N. lat. it is hardly more than 1000 feet. It sinks still lower south of that line, where, running from north to south, it forms the watershed between the rivers that fall into Lake Wenern on the west, and those running to Lake Mälaren to the east, and farther south separates the basins of the lakes Wenern and Wettern. In these parts it is called the Tifveden range, and it attains only a height of from 500 to 700 feet above the sea-level, and from 300 to 400 feet above its base. It seldom exceeds three or four miles in width.

The country to the east of this ridge and of the mountain-system of Mount Sylfiellen, and north of a straight line drawn from Söderhamn on the Gulf of Bothnia through the most southern bay of Lake Siljan, until it meets the ridge of the Tifveden Mountains, resembles in its great features the countries which lie farther north, consisting of a

higher, lower, and lowest tract. The higher tract, whose general level is more than 800 feet above the sea, is the most extensive: it stretches from the mountains to the western extremity of Lake Siljan, a distance of about 40 miles. North of that lake it extends much farther to the east, and here it occupies from west to east about 80 miles, leaving between it and the sea a space not quite 40 miles wide. The surface is less broken than that of the regions farther north, consisting chiefly of long and gentle swells, the summits of which form levels of considerable extent. A few hills are dispersed over these summits, but their sides are not steep, and they do not rise more than 300 or 400 feet above their base. These hills are numerous in the vicinity of the mountains, especially on the west of Lake Siljan, but they become rarer in the country farther east. Agriculture is limited to a few valleys of moderate extent, and to the low grounds surrounding the lakes, where rye, barley, and especially oats, are cultivated, and some vegetables are grown. Domestic animals are reared, chiefly cattle, sheep, and goats. The goats are more numerous here than in any other district of Sweden. Nearly the whole tract is covered with forests, the produce of which finds a ready sale in the adjacent Region of the Mines.

Lake Siljan, which is situated near the southern border of this tract, is of considerable extent: its length from north-west to south-east exceeds 25 miles, and for nearly 15 miles it is six miles wide: its surface is 555 feet above the sea-level. On the west and south it is surrounded by very low hills, alternating with level plains. On the south and east the hills are much higher, but the declivities are usually gentle, and enclose narrow fertile valleys. In the district surrounding this beautiful lake agriculture is conducted on a larger scale than in the country to the east and north of it.

The eastern portion of this region, extending from the Gulf of Bothnia about 40 miles inland, is an inclined plain, which gradually rises from the sea to an elevation of 800 feet. The ascent is somewhat more rapid in its western part, and the whole may be divided into two equal sections running parallel to the sea, of which that on the shore rises in the space of 20 miles from the level of the sea to 300 feet, and farther inland in an equal distance from 300 to 800 feet. The surface of this tract is interspersed with numerous hills of moderate elevation and with lakes. Most of the hills have gentle declivities, but a few of them are steep. A plain of considerable width extends along the shores from 61° 40′ N. lat. to the mouth of the Dalelfven (60° 40′): this is the most northern part of Sweden in which wheat is grown. Barley and potatoes are most extensively cultivated; rye, oats, and peas are also grown. Sheep and cattle are very numerous, and there are also other domestic animals. The soil of this region is better than it is farther north, containing a greater proportion of clay mixed with the gravel and sand.

According to a rough estimate founded on data taken from Forsell, the area of this region is thus divided:—The mountain-system of Mount Sylfiellen, as far as it belongs to Sweden, comprehends 1220 square miles; and the extensive region, which is more than 800 feet above the sea-level, comprehends 6137 square miles. A tract of land west of the Tifveden range, at the base of the Sylfiellen mountains, is lower than 800 feet, and occupies about 870 square miles. The country surrounding Lake Siljan, which is on an average 600 feet above the sea, contains 1221 square miles. The lower region along the Gulf of Bothnia has an area of 3776 square miles, and is equally distributed between that tract which is more than 300 feet high and between that which sinks lower. The cultivated ground probably does not exceed 100 square miles, but the meadows and rich pasture-grounds occupy more than four times that extent.

4. South of the region just described extends the *Region of the Mines*. It occupies the whole bread thof Sweden, extending from the boundary of Norway to the Gulf of Bothnia from south-west to north-east. Its northern boundary is a straight line drawn from the great bend of the Glommen at Kongsvinger, through Lake Siljan to Söderhamn. Its southern boundary runs west of Lake Wenern, along 59° N. lat.; east of that lake it begins at 59° N. lat., whence it runs east-north-east to the town of Orebro, at the western extremity of Lake Hielmaren, and thence north-east to the most southern bend of the Dalelfven, which river forms the boundary from that place to its mouth. The area is 16,000 square miles, or twice that of Wales. The Tifveden ridge crosses it nearly in the middle; and its elevation in these parts probably never falls below 1000 feet above the sea. This is the greatest elevation of the region, whose slope on the west of the range is directed towards the south, and terminates on the banks of Lake Wenern. Two-thirds of this slope are less than 300 feet above the sea. The country lying east of the Tifveden ridge slopes to the south in the southern and to the east in the northern districts. Its elevation above the sea is never less than 300 feet, except on the level plain along the Gulf of Bothnia from Söderhamn to the mouth of the Dalelfven. On the west side of the great southern bend of the last-mentioned river, and only a few miles from it, is a tract of considerable extent, which rises from 800 to 1000 feet above the sea. The surface of this region is exceedingly uneven, and it is covered with a succession of low unconnected hills, the slopes of which are very gentle, and generally covered with wood. The low grounds between the hills are of small extent, and the lowest part is generally occupied by a small lake or by a marshy tract. These small lakes and marshes are almost countless. Some of these lakes however are several miles in length. In the country west of the Tifveden ridge the lakes lie from north to south. The largest among them are, from west to east, the lakes Legen, Lelanf, Glas, Wermelen, Mellan, and Ofre, each of which is above 20 miles long, but they seldom exceed two miles in width. The lakes to the east of the Tifveden ridge have a more irregular form, and are not so large. South of the Delelfven are the lakes Wesman, Barken, and Amänningen, and north of it Runn and Storsiön: the last-mentioned lake is in the low country west of Gefle. Though the soil of this region consists chiefly of gravel and sand with a mixture of clay, nearly every spot that is of any value is carefully cultivated, as there is a ready market for the produce among the miners, whose number is proportionally very great, the greatest number of the iron-mines of Sweden and the richest being situated within this region. But only few spots admit of cultivation; and most of them are on the banks of the lakes, and they are of small extent. Oats are most extensively cultivated, and next to them rye; barley and wheat are little cultivated. Potatoes and peas are grown to a considerable extent. In a few places there are good pastures; and cattle, sheep, horses, and hogs are numerous in the southern districts. Though the soil is inferior to that of many districts farther north, a larger portion of it is under cultivation than in the more northern provinces. The arable lands occupy about 400 square miles, or one-fortieth part of the area. But the meadows, or enclosed pasture-grounds, hardly extend over more than 800 square miles. Thus only three-fortieth parts of the surface produce food for man: the remainder is covered with trees, few of which produce timber, but they are valuable for the working of mines.

5. To the south-east of the Region of the Mines is the *Central Agricultural Region*, which comprehends the greatest extent of low country in Sweden. No part of this tract exceeds 300 feet above the sea-level. Its southern boundary is a higher tract, which is connected with the Tifveden ridge, north-west of the northern extremity of lake Wettern, and extending from the ridge eastward, terminates on the north shores of the bay called Bräviken, on the shores of the Baltic. The area of this region is about 10,353 square miles, which exceeds that of Wales by a little more than 2000 square miles. The population is about half a million, and consequently there are 48 individuals to each square mile, while in Wales there are 112, according to the census of 1841. That portion of the region which is north of lake Mälaren is nearly a level plain, interspersed with a few isolated and low hills, which occur at great distances from one another, and are more numerous in the northern than in the southern districts. In the southern districts there are some sandy hills, which run from east to west, and extend several miles. The country south of the lakes Mälaren and Hielmaren is more undulating, and in some places it is broken and interspersed with rocks. In these districts there are numerous lakes, which are not common in the country north of the lakes. Though the substratum of this region is rocky, the surface consists of sand, with which a considerable proportion of clay is mixed, which gives to the country a greater degree of fertility than is usual in Sweden. This is shown by the greater proportion of the surface which is under the plough, which is more than 603 square miles, or nearly

one-seventeenth part of the area. If we add to this the area occupied by meadows and pastures, which amounts to 924 square miles, we find that more than one-seventh of the surface is employed to produce food for man. Rye is the principal object of cultivation, and the produce is greater than that of all other grains taken together. Next to rye are barley and wheat; very little oats are grown, but potatoes and peas are largely cultivated. Cattle and sheep, horses and hogs, are numerous.

6. South of the central agricultural region is the *Plain of Linköping*, which is separated from the central region by a more elevated tract, which surrounds the northern extremity of the lake Wettern, and extends eastward with a width of about 18 miles, until it approaches the bay of Bråviken, when it contracts to a ridge hardly two miles wide. This narrow ridge, which is called Kolmoren, runs along the northern shore of the bay to its termination in the Baltic. The general elevation of this tract is between 300 and 400 feet above the sea, and about 200 feet above the lower countries north and south of it. The surface is uneven and in many places interspersed with rocky eminences, between which there are numerous lakes of some extent. The greater portion of this tract is covered with wood, especially pine, fir, and birch. The soil is very variable, but the fertile tracts are not numerous. In general this tract is better fitted for pasturage than for cultivation.

The plain of Linköping is certainly one of the most fertile, if not the most fertile tract in Sweden. From the shores of the Baltic to the banks of lake Wettern, from east to west, it measures above 60 miles. West of the town of Linköping, which is situated nearly in the centre of the plain, its average width is 30 miles, of which one-third is north of the Göta Canal and two-thirds south of it. In the meridian of Linköping the plain begins to grow narrower, as the hilly country which lies along the Baltic, south of the plain, advances farther north. East of the meridian of Norrköping it is hardly 15 miles wide. Its area is about 1500 square miles, or nearly that of Hampshire. The surface is generally level, interrupted in a few places by low hills with very gentle slopes, and in the vicinity of the hills, which surround it on the south and north, by a few low rocks. From the shores of the Baltic the country rises gradually towards the west, so that lake Roxen, which is nearly in the middle of the plain, is 106 feet above the sea-level, and on the banks of lake Wettern the country is about 300 feet high. It is only in the vicinity of the efflux of the river Motala that the level reaches that of Lake Wettern, whose surface is 287 feet above the sea-level. At the distance of about 10 miles south of the efflux of the river, there rises, on the shores of the lake, Mount Omberg, whose summit is 845 feet above the sea, and from this hill a ridge of elevated ground runs southward close to the borders of the lake, separating it from the plain. The soil of the plain is a mixture of clay and sand, and in some places of loam, especially towards Lake Wettern, where also its fertility is much greater than in the eastern districts. In no other part of Sweden is wheat so extensively cultivated as in this plain, but rye and barley are grown to a still larger amount. Peas and potatoes are also much grown. Along the numerous watercourses, especially to the south of the Motala, and on the banks of the river, there are extensive flats, which are inundated in spring, and make excellent meadow-grounds. All kinds of domestic animals are numerous, with the exception of goats. There are however some extensive tracts which are not cultivated, but are covered with woods, especially birch. The inhabitants derive their fuel from these woods, and use them as pasture-ground in certain seasons of the year. These unenclosed tracts cover more than one-third of the plain, for all the cultivated tracts do not occupy more than 200 square miles, and the meadows and enclosed pasture-grounds occupy about 750 square miles.

7. To the south of the plain of Linköping rises the *Table-land of Småland*. This extensive region, with its declivities, occupies nearly the whole of the country south of 58° N. lat., leaving only comparatively narrow tracts of lower grounds along the sea, which bounds it on the east, south, and west. At the south-western extremity of this region is the extensive level of Scania. The eastern border of the table-land itself is west of 16° E. long., but not far from it, and the southern border is a short distance south of 56° 30′ N. lat. The western border runs parallel to the shores of the Cattegat, at the distance of about 15 miles. The northern boundary of the table-land is generally well defined by the parallel of 58° N. lat., but on both sides of Lake Wettern the high country extends a few miles farther north. A rough estimate, founded on data from Forsell, gives to this table-land a surface of more than 14,000 square miles, or nearly double the area of Wales. Along the outer borders the elevation of the table-land is between 300 and 400 feet above the sea-level, but in the centre it rises much higher. The highest part, extending over about one-third of the region, is more than 800 feet above the sea. It surrounds the southern extremity of Lake Wettern, and extends from it southward for about 36 miles. This, the most elevated portion of the table-land, is traversed by a ridge of higher ground, which may be considered as a continuation of the Tiveden ridge. This last-mentioned ridge, which is between 500 and 600 feet high where it separates the basins of the lakes Wenern and Wettern, continues southward along the western banks of Lake Wettern, preserving nearly the same elevation, but interrupted in some places by short depressions; but as it approaches the southern extremity of the lake it rises higher, and where it meets the table-land it has an elevation of more than 900 feet. Nearly 10 miles south of the lake there rises on this ridge a high hill, called Taberg, whose summit is 1100 feet above the surface, and has attracted the attention of geologists, as about three-fourths of it consists of pure ironstone. From this summit the ridge runs westward, and near the centre of the higher portion of the region it again rises to more than 1100 feet above the sea, and divides into two branches, of which one runs west and the other south-west: both of them terminate on the margin of this region. The general elevation of this ridge may be about 1000 feet above the sea, and less than 200 feet above the general level of the country. This is the highest ground in Sweden south of 60° 30′ N. lat. The surface of the table-land varies greatly. There are many tracts of considerable extent, which are level plains: other districts have a broken surface. On the higher part of the table-land there are only a few lakes, but in its western district, and still more its southern, they are very numerous, and some of them are at a considerable elevation. Lake Helga, north of Wexiö, is 472 feet above the sea-level. As the table-land is not protected by a range of mountains against the winds, it suffers much from gales, and its climate is severer than that of the adjacent lower districts. The winter lasts seven months: the cold is very intense for three months, and a great quantity of snow falls. This last circumstance however must be considered advantageous, as it gives to the dry soil that degree of moisture which enables it to maintain vegetation all the year round. The great mass of rocks on which the table-land rests is composed of gneiss, and as these rocks when disintegrated form the worst kind of soil, this region is of very moderate fertility. Tracts many miles in length and width are covered with sand, on which nothing grows but common heath, and some spots are quite destitute of vegetation. Where the soil is mixed with a little vegetable mould, the country is covered with wood, especially birch; but the trees have not a vigorous growth, except in the more hilly tracts which lie along the outer borders of the table-land. In those districts whose surface is uneven, there are tracts with a better soil, which are cultivated with great care, but they hardly pay for the labour bestowed on them. The best tracts are those which surround the lakes. Wheat is grown in a few places, but they are of small extent, and the produce is scanty, yielding only from three to four times the seed. Rye yields about four times the seed, and is rather extensively cultivated. The principal grain raised on the higher part of the table-land is oats, and on the lower part barley. Potatoes are much cultivated on the higher part. The cattle, sheep, and hogs are rather of small size, and the wool of the sheep is very coarse. The meadows are bad, with the exception of some tracts along the lakes, and the pasture-grounds in the woods have little grass. Though much has recently been done to extend cultivation to those tracts, which were formerly lying waste, that portion of the area of the table-land which produces food for man does not much exceed 160 square miles, or one-ninetieth part of the whole; and of this extent only one-fifth, or little more than 30 square miles, produces corn and vegetables: the remainder consists of meadows and enclosed pastures.

8. *The Maritime Region of Småland*, or the eastern declivity of the table-land of that name, extends opposite

the island of Oland, from south to north, but it advances northward within five or six miles of the Göta Canal. Its length rather exceeds 140 miles, but the width is inconsiderable for two-thirds of its length, not much exceeding 15 miles, though towards the north it widens to nearly 25 miles. Its area is about 2700 miles. The general level rises mostly with a north-western slope from the sea to the table-land, near the borders of which it attains an elevation of 300 feet above the sea-level. The surface presents great varieties. The southern districts, or about one-third, are rather undulating than hilly; and between the slight elevations there are extensive flats. The soil of this tract is generally sandy, and of indifferent quality. The greater part is covered with woods, consisting mostly of fir and birch, bu. there are few timber-trees. The northern districts, or rather more than two-thirds of the whole, have a much more broken surface, presenting a succession of hills, valleys, and small plains. The hills are generally steep, and enclose narrow valleys. Some of the most extensive lower tracts are filled with lakes. The soil contains a greater mixture of clay or vegetable mould than farther to the south, but as in many places it has little depth, and in other parts is very stony, these districts are not much better adapted for cultivation than the southern. Nevertheless a comparatively large portion of the surface is under the plough. But most of the valleys and declivities of the hills, though unfit for cultivation, produce abundance of grass, and there are pasture-grounds and meadows. But the forests, which cover all the hills and the rocks, constitute the great wealth of this tract: they contain pine, fir, birch, beech, and oak, and a considerable number are large trees. Timber is the principal article of export; tar and pitch are also exported. Rye and barley are extensively cultivated, and generally yield five times the seed. Oats are not much grown, and wheat only in a few more favoured tracts. Potatoes however are much planted, and this branch of agriture is continually increasing. Domestic animals of every description, with the exception of goats, are abundant, which is shown by the extent of the meadows and pasture-grounds, which cover about 420 square miles, or more than one-seventh of the region, whilst the area of the part under cultivation does not exceed 90 square miles, or only one-thirtieth part.

The island of Oland, which is opposite this region, may be considered as an appendage of it. This island lies parallel to the coast, and is very long, but comparatively narrow. The length somewhat exceeds 80 miles; the width varies between eight and two miles, and on an average may be estimated at five miles, which gives an area of 400 square miles. The surface consists of a long uninterrupted swell, which is never more than 200 feet above the sea-level, and generally only half as much. This swell is composed of chalk, which is covered with a layer of earth, and its fertility is superior to that of the opposite coast. The northern part is covered with woods. The greatest portion of the islands is used as pasture-ground, and the ponies are distinguished by their strength: they are exported in great numbers. Rye and barley are extensively cultivated, and also other kinds of grain to a small amount.

9. The *Maritime Region of Blekinge* extends over the southern coast of Sweden from about 14° 30′ to 16° E. long., somewhat more than 50 miles in length. Its width may be estimated at 15 miles. The surface does not exceed 770 square miles. This is the most broken portion of the Swedish coast. The rocky masses of the table-land of Smäland divided into small ridges by numerous watercourses, which run in deep and narrow valleys, advance within a short distance from the shores, where they terminate in hills from 200 to 300 feet high. East of the town of Carlskamn these rocky masses come close up to the sea, so as not to leave any level space for a road. The small rivers, descending from an elevated tract more than 400 feet above the sea-level, and falling into the sea at a distance of only 15 miles from it, are extremely rapid, and form many small and beautiful cataracts. The level grounds are much less extensive in this region than in any other part of Sweden, but they possess a considerable degree of fertility. They are cultivated with care, and the crops return in general six times the seed, and in some places more. Wheat is much grown, though the cultivation of rye is ten times more extensive; but in other districts of Sweden the disproportion is still much greater, except in Scania, the plain of Linköping, and the southern part of the Central Agricultural Region. Barley and potatoes are also much cultivated. The meadows in the valleys along the banks of the river, though not extensive, yield abundance of grass; and the slopes of the hills make excellent pasture, though their summits are almost destitute of such vegetation as is adapted for useful purposes. In some parts they are covered with wood, especially birch and fir; but these trees have usually a stunted growth, though there are large trees in the valleys, and among them some beech and oak. The rearing of cattle and hogs constitutes one of the principal objects of domestic economy, and much cheese is made. The proportion of the area which produces food for men is much larger than in most other regions, as nearly one-sixth of the whole surface, or about 45 square miles are cultivated: the extent of meadow-grounds and enclosed pastures is double that amount.

10. The *Plain of Scania* occupies all the peninsula which constitutes the most southern portion of Sweden, between the Sound on the west and the Baltic on the south and east. A straight line drawn from the innermost recess of the Skelder Vick, a large and open bay of the Cattegat, on the west, to the peninsula of Sölvetsburg on the east, may be considered as marking tolerably well its northern boundary, where it joins the table-land of Smäland and the maritime regions of Blekinge and of Halland. It extends from south to north about 55 miles; the width varies between 50 and 60 miles, being greater towards the north than along the southern coast: it hardly exceeds 3000 square miles, so that it is only about 200 square miles larger than the county of Lincoln, to which it bears some resemblance in its surface, soil, and products. It is not a level plain, but is traversed in its length by a low broad swell of high ground, which begins at the most north-western point of the plain with Cape Kullen, a moderately elevated headland at the northern opening of the Oresund. From this point it extends in a south-east direction to the lakes called Ringsïon, where it enlarges to a great width, enclosing these lakes, and covering a space of considerable extent with numerous hills, most of which are covered with wood. From the banks of these lakes it declines a little more to the south, running towards the south-east portion of the plain; but it terminates, about twelve miles from the sea, in low hills. The tract of country between the termination of this swell and the south-eastern shores of Scania is a level, with numerous depressions, which are occupied by marshes and swamps. That portion of the region which is situated to the south-west of the swell contains a large level plain, which extends along the shores of the Oresund, from the southern extremity of the peninsula to the vicinity of Helsingborg, varying in width from 6 to 10 miles: it is wider towards the south than towards the north. The soil of this tract is of first-rate quality, consisting of a strong rich loam, which yields good crops of wheat, the produce varying from eight to twelve times the seed. This large tract is under cultivation, with very few exceptions. The country between this rich plain and the swell above mentioned is not so level, being interspersed with small isolated hills, which are very numerous in some parts, especially to the south, where they also rise to a greater elevation. One of them, called Romele Klint, is 291 feet above the sea-level. The soil of this tract, though better than that of most other districts in Sweden, is much inferior to that of the plain, and it contains a great deal of sand. Rye and barley are extensively grown; the rye yields from seven to nine times its seed, and the barley about six times. The hills are in some places covered with wood, but in others destitute of trees, and make only indifferent pasture-grounds. That portion of the plain which lies north-east of the swell contains also a considerable level round the town of Christianstad, which has a fertile soil, but it is not equal to that of the plain along the shores of the Oresund. Wheat and rye are cultivated. The remainder of the country resembles the hilly district west of the swell in surface, soil, and productions. As the hilly tracts occupy more than three-fourths of the plain, and only a small portion of them is cultivable, the remainder is used as pasture-grounds for sheep, which are more numerous here than in any other part of Sweden, and the wool also is better. The high state of cultivation in the level tracts requires a considerable number of horses and oxen, and these animals are likewise more abundant than elsewhere. The same remark applies to the hogs. Only a few goats are kept in the hilly districts. More than one-half of the region, or 1666 square miles, is not regularly cultivated for the pro-

duction of food, and is used only at certain seasons as sheep-walks. The cultivated fields are calculated to cover an area of 654 square miles, and the enclosed pasture-grounds and meadows 680 square miles.

11. The *Maritime Region of Halland*, which extends along the eastern shores of the Cattegat, is the western declivity of the table-land of Smäland. Its southern boundary is on the shores of the Skelder Vik, whence it extends northward to the mouth of the Göta Elf, which two parts are nearly 112 miles distant from one another; but its width is inconsiderable, being in general about 15 miles. The area is about 1800 square miles. The level portion of this region is separated from the plain of Scania by a tract of high land, which projects from the south-western corner of the table-land of Smäland, and running westward, terminates in the peninsula of Halland's Äs, between Skelder Vik on the south, and the Bay of Laholm on the north, close to the sea. This high land rises in general from 400 to 500 feet above the sea-level, and the highest part resembles the table-land, being mostly a level, but frequently interspersed with hills. The soil is sandy, partly covered with heath, and partly wooded. In some places there are swamps. Beech is abundant, and there are many large trees. The width of this elevated tract is about eight miles. To the north of it lies the most level portion of the region, which extends to 57° N. lat., and even a little farther, to the vicinity of Warberg. In these parts the slope of the table-land of Smäland is more regular than that on the south and east. It descends with a continuous declivity, which is only broken by the watercourses, nearly to the sea-level, leaving between its base and the shores a tract of undulating ground about 8 miles wide. The soil, though inferior to that of the plain of Scania, and even to that of the maritime region of Blekinge, is generally above mediocrity, yielding between four and five times the seed of rye and barley: it is seldom strong enough for wheat or peas, but it produces abundant crops of potatoes. The slopes of the hills at the back of the undulating plain make good sheep-walks. The northern districts of this region, from Warberg to the mouth of the Göta Elf, have a much more broken surface. Rocky hills of moderate elevation extend from the table-land to near the shores of the sea, and between them are wide valleys, which are partly filled with long lakes, which lie in the direction of the general slope, which is to the south-west. Though a few of the hills are without vegetation, most of them are covered with stunted trees or with grass. On the banks of the lakes there are large meadows; and the pasture-grounds on the hills, though not rich, are very extensive. Large numbers of sheep and cattle are kept, and also many horses. Only a small portion of this tract is under cultivation, and it produces chiefly rye and barley. The cultivated portion of the whole region has been estimated at about 123 square miles, and the meadows and enclosed pasture-grounds occupy 224 square miles. More than one-sixth of the whole country is employed in producing food for man.

12. The *Southern Basin of Lake Wenern* extends over the wide isthmus which separates the two lakes of Wenern and Wettern. The parallel of 58° may be considered as its southern and that of 59° with the Tifveden ridge as its northern boundary; on the west it borders on the Göta Elf. The basin of lake Wenern is very limited on the east and west. On the east the Tifveden ridge, running parallel to its eastern banks, is only about 8 or 9 miles distant. On the west the stony masses of the rocky region advance still nearer to the border of the lake. But towards the south the basin of the lake extends about 60 miles, and to the north 120 miles. The northern portion of this basin forms part of the region of mines, and the southern constitutes this region. The area of this region may be about 3950 miles. From south-west to north-east it measures more than 80 miles, but the width, which at its southern boundary is 70 miles, grows less as it proceeds northward along the south-eastern shores of lake Wenern, until at 59° N. lat. it is hardly 10 miles wide. The greater part of this region is an inclined plain, which descends northward towards its lowest level, lake Wenern, with a gentle declivity, and on the east and south is surrounded by higher land. At its most northern boundary the Tifveden ridge enters the region, and between the lakes Skagern and Unden it runs south-west. In this part of the country it is about 550 feet above the sea-level, 416 feet above lake Wenern, and 263 feet above lake Wettern. Soon afterwards it turns to the south, and is interrupted by a deep depression, containing lake Vikeu, which is only 296 feet above the sea-level, or 11 feet above lake Wettern. South of this lake the ridge gradually rises higher, and south of the middle of the last-mentioned lake it attains a general elevation of 800 feet, and soon joins the table-land of Smäland. The northern edge of this table-land constitutes the southern boundary of the plain, which descends from it gradually and with a gentle declivity northward. On the plain there are a few isolated mountains of considerable height, consisting of sandstone, limestone, and alum slate. The highest and most extensive of these mountains are the Billungen and the Kinne Kulle. The Billungen is nearly in the centre of this region, north-east of the lake of Hornborga, and is above 10 miles long, with an average width of three miles: it is 899 feet above the sea. The Kinne Kulle stands on the banks of lake Wenern, and is 9 miles from south to north, and 5 miles wide: the highest part is 902 feet above the sea-level. The declivities of this mass, where they consist of limestone, are very fertile, well cultivated, and populous. Hunnberg and Hallberg, which stand near the most southern extremity of lake Wenern, are similarly formed, but of much less extent, and do not rise to half the elevation of the Kinne Kulle. Though the general slope of the plain is regular, its surface is only occasionally level, and is often undulating. The soil is an alluvium, composed of sand and clay, and possesses a considerable degree of fertility: some tracts where the sand predominates are covered with heaths. Rye and barley are extensively grown, but not much wheat or oats. Wheat and rye yield six times their seed, but barley and oats only four times. Potatoes are grown to a great extent, and yield ten times the seed. The meadows and pasture-grounds are less valuable than in most of the other provinces of Sweden, except on the borders of the lakes. The cultivated ground is stated to occupy about one-eleventh part of the area, or 352 square miles, and the meadows and enclosed pastures about one-seventh part, or 563 square miles. That part of the surface therefore which is regularly employed in producing human food considerably exceeds one-fifth of the whole area.

13. The *Rocky Region* extends over the north-western portion of Southern Sweden, occupying the whole tract between the course of the Göta Elf on the west and the Skagerack on the north, as far as 59° N. lat. and the boundary-line of Norway. From south to north it measures nearly ninety miles; but the width, which at the southern extremity hardly exceeds ten miles, increases as we proceed northward, so that at the northern boundary it is rather more than 55 miles across. Its area is about 1800 square miles. It may be divided into three districts, which extend longitudinally over the region. The rocky district lies along the shores of the Skagerack, and extends ten or twelve miles inland; the southern part of the region, as far north as Tyrollhättan, is entirely occupied by it. The surface of this tract is covered with rocks, rising near the sea with a precipitous ascent from 100 to 300 feet, and then extending in some parts on a level, with very inconsiderable depressions or eminences, and in others with a hilly surface. Farther north, especially near the boundary of Norway, the rocky masses rise 400 or 500 feet, and on them there occur other masses, which are from 100 to 200 feet higher. The rocks are in general only covered with lichens; and most of the narrow or flat valleys, in which a thin layer of earth occurs, are only peat-mosses, or overgrown with juniper bushes. Very few of them contain trees, or are cultivable. Even fire-wood is scarcer than in any other part of Sweden, except the plain of Scania. The middle tract may be called the wooded district. It begins in the parallel of the southern extremity of Lake Wenern, where it is of inconsiderable width, but it grows wider as it proceeds farther north, where it is 25 miles across. The surface is from 300 to 500 feet above the sea, and towards the north it rises higher. The hills and rocks with which it is covered have rounded tops, and the declivities are much less precipitous: they are generally covered, both on the tops and declivities, by a layer of earth, and are wooded with birch, fir, and pines, and make tolerable pasture-grounds. The depressions and valleys are rather extensive and wide. They are from 100 to 200 feet below the higher surface, and contain many cultivated tracts, whilst others are used as meadows, especially along the numerous lakes. The eastern portion of the region is an agricultural district, which lies along the banks of Lake Wenern, and runs from its most southern extremity near

Wenersborg to the north of 59°. But it is not of great extent, as it only reaches a distance of six or eight miles from the borders of the lake. The surface of this tract towards the south is very even and slightly elevated above the level of the lake, of which it formerly seems to have constituted a portion, as the whole is covered with a rich alluvium. Towards the north however the low offsets of the hills which lie farther west advance nearly to the shores of the lake, and render the surface of this tract undulating, and in some places hilly. But the soil is of good quality, being a mixture of clay and loam. In this district much rye and barley are cultivated, and a considerable proportion of wheat. Peas and potatoes are grown extensively. Peas are stated to yield fourteen times their seed, potatoes ten times, and rye twelve times. The agricultural produce of this tract finds a ready sale in the Region of the Mines. In the other two districts, where the soil is very light and contains much sand, oats and potatoes are the most common objects of cultivation. The wooded district has good pasture-grounds for cattle, and the rocky part contains, in many places, good sheep-walks. The extent of the cultivated tracts is about 170 square miles, or more than one-eleventh part of the whole area; and that of the enclosed pastures and meadows is 280, or more than one-seventh. Thus one-fourth of this region is employed in producing food for man.

From this description of the natural regions of Sweden it is evident that the proportion of cultivated land, and of the meadows and enclosed pastures, is much greater in the southern provinces than in the northern. If a line is drawn across the country in the parallel of the town of Gefle, it appears that the part of Sweden which is situated to the north of that line contains 110,180 square miles, or, exclusive of the lakes and swamps, which occupy 11,524 square miles, 99,676 square males. The provinces south of the line contain 60,300 square miles, or, exclusive of the lakes and swamps, which cover 10,422 square miles, 49,878 square miles. Thus the northern portion contains somewhat more than two-thirds of the whole area. In the northern provinces the meadows and enclosed pastures, taken together, occupy only 1498 square miles, or less than one sixty-sixth part of the country; but in the southern parts they amount to 5062 square miles, or to more than one-twelfth part of their surface. The surface covered by the cultivated fields in the northern portion is only 357 square miles, or a little less than one 280th part, whilst in the southern portion it occupies 3093 square miles, or nearly one-twentieth part of the area.

This difference is less the effect of the climate than of the soil. Though in the southern portion there are several extensive tracts which consist of bare rocks, as on the table-land of Småland and in the Rocky Region, they are small in proportion to tracts of the same kind in the extensive regions of the north, whose surface is composed of bare rocks. The boulders diminish the extent or value of the cultivable tract: there hardly occur ten square miles, with the exception perhaps of the level plain of Scania, in which there are not erratic rocks in great numbers, and in some places they cover nearly half the surface. These rocks, as well as those *in situ*, are of gneiss, and the soil derived from their disintegration is barren. The most fertile tracts are those which have an alluvial soil, and next to these the soils where the rock is limestone, which frequently occurs in the southern parts, but only at one place in the northern, on the table-land of Jemtland, in the country surrounding the Storsiön or Great Lake.

The lowering of the sea along the coast of Sweden is a fact that has been much questioned, but it seems established beyond all doubt by continued observations for a whole century. This decrease of the water is greatest towards the northern extremity of the Gulf of Bothnia, where the difference observed within a century has been found to amount to four feet. In proceeding southward it diminishes gradually, and its effect seems to disappear along the southern coast of Sweden in Blekinge and Scania: but it has been noticed in the Cattegat north of Cape Kullen, and still more north of the mouth of the Göta Elf, where it is about as much as on the eastern coast, which is situated under the same parallel. It is not known whether it has taken place on the coast of Norway, no observations having been made there. The difficulty of explaining this phenomenon satisfactorily has suggested the notion that the whole Scandinavian peninsula is raised gradually higher by the force of some internal power.

Lakes; Rivers; Canals.—The number of lakes in Sweden, large and small, is very great. According to the estimate of Forsell, they cover 21,946 square miles, or nearly one-eighth of the area of the kingdom. In the northern mountainous district they render the country habitable, as the best meadows which are found there lie on their banks, and as their fish supply the principal food on which the inhabitants subsist. Some of the larger lakes have been already mentioned. We shall here notice those which facilitate the commercial intercourse of the country.

The largest lake is the Wenern, which is traversed by 59° N. lat.: the surface is 144 feet above the sea-level. The two headlands projecting from the northern and southern shores divide it into two unequal parts, of which the western and smaller is designated by the name of Lake Dalbo. Lake Dalbo extends from south to north about 55 miles, and from east to west 20 miles. The passage by which it is connected with Lake Wenern is about 15 miles wide, but numerous small rocky islands lie across the strait, leaving only narrow passages, a circumstance which renders the navigation dangerous, on account of the gales, which are not unusual on the lakes. Only four of these passages have depth enough for the vessels that are used on the lake. Lake Wenern is 60 miles long from south to north, and 30 miles wide where broadest. A large part of the shore is lined with rocky islands: this is also the case with Lake Dalbo. The two lakes cover a surface exceeding 2000 square miles, and receive the waters of numerous rivers. Those which fall into it from the south have not a long course, and do not bring much water; but the northern rivers flow from other lakes of considerable extent, and contain much more water. The largest river is the Klar Elf.

The Klar Elf originates in that elevated mountain-range which extends along the boundary-line between Sweden and Norway, south of the Sylfiellen. Several small rivers, the outlets of lakes, fall into Lake Fämund, which is 2290 feet above the sea, and is situated within Norway. The river issuing from its south-western extremity is called Tryssild Elf, and runs southward. After a rapid course of more than 70 miles, it enters Sweden a little north of 61° N. lat., and takes the name of Klar Elf. At this point it is probably not more than 600 feet above the sea-level, or 456 feet above its outlet in Lake Wenern. Its course in Sweden is first south-south-east, and afterwards south-east, and it runs more than 120 miles, without taking into account its numerous windings. In the upper part of its course in Sweden its current is comparatively gentle, but in the vicinity of 60° N. lat. it descends from a higher country to a lower, and falls more than 130 feet within a few miles, and is broken by rapids and cataracts. Below this place the river runs with less rapidity, but it cannot easily be navigated except in the last 20 miles of its course. Wood however is floated down from the upper country. Near its mouth it divides into two arms, which enclose a small island called Tingwalla, on which the town of Carlstad is built.

The waters of Lake Wenern are carried to the Cattegat by the Göta-Elf, which runs more than 50 miles, to the west of south. It has a great volume of water, and about 14 miles from its mouth, near Kongelf, divides into two arms, which enclose the large island of Hisingen. In its natural state the river was rendered unfit for navigation by several cataracts, which occur in the first 18 miles of its course, within which distance the river descends about 130 feet: but art has supplied this deficiency. The first cataract is about two miles from the place where the river leaves the lake, near Ränum, and is called the Cataract of Ränum: it is more than 15 feet high: it is now avoided by the Charles Canal, which begins on the eastern side of a small bay of Lake Wenern, called Wasbotton, and extends south-east, joining the river more than two miles below the cataract. It is about two miles long. About four miles below the place where the Charles Canal joins the river, the rapids of Trolhättan commence, which occupy about five miles, within which space the river descends 108 feet. The canal, by which they are now avoided, is cut through the rock, and is considered one of the most perfect works of its kind: it is called the Trolhättan Canal. A fall near Akerström, more than three feet high, is avoided by a short cut and a lock. The last cataract occurs at Lilla Edet, about 18 miles from the efflux of the river, and is nearly 10 feet high, and is likewise avoided by a single lock. A few rapids occur lower

down, especially at Hanström, two miles below Lilla Edet but they present no great obstacles to navigation. Thus the Göta Elf has been rendered navigable for vessels not drawing more than six feet of water; and the whole country about Lake Wenern has the advantages arising from an easy water-communication with the sea. The Trollhättan Canal, which was finished in 1800, is about two miles long, and has eight locks.

Lake Wettern, which occupies the centre of Southern Sweden, extends from south to north about 80 miles, and its width is about 10 miles. The surface is about 900 square miles. It is on the highest general level of Sweden, between 57° and 58° N. lat., and the surface is 288 feet above the sea, while at the distance of a few miles east and west the level country is several feet lower. It is surrounded by rocks and hills, except on the north-east, where for nearly 20 miles it is contiguous to the plain of Linköping, and the shores rise only a few feet above its level. In these parts it also receives the only river that enters it; for all the other streams that flow into it are only torrents. It partakes of the nature of an alpine lake, being in one place more than 70 fathoms deep. It is subject to heavy gales.

The river Motala issues from this lake on the north-east, and after having traversed the plain of Linköping, carries its waters to the Baltic. The distance between the eastern shores of the lake and the Baltic in a straight line is about 64 miles. The course of the river, notwithstanding its windings, is shorter, as it falls into the western end of the Bay of Bräviken, which enters about 24 miles inland. The Motala flows first eastward, traversing, at the distance of three miles from its efflux, Lake Boren, which is 237 feet above the sea, and 51 feet below the level of Lake Wettern; and at the distance of about 10 miles from the place where it leaves Lake Boren it enters Lake Roxen, which is 101 feet above the sea, and 187 feet below the level of Lake Wettern. The river leaves Lake Roxen at its eastern extremity, and changing its direction runs west by north seven miles to Lake Glan, which is only 68 feet above the sea-level. Leaving this lake it runs again to the east, and after a course of about five miles it enters the Bräviken at the town of Norrköping. The whole course of the river, exclusive of the lakes, is only about 25 miles, and it descends 288 feet, or 11½ feet per mile. The channels by which the lakes are connected with one another are too rapid for navigation.

The abundance of water on this line has been used for establishing the canal system which is called the Göta Navigation, from its crossing the southern part of Sweden, which is called Götaland. A canal has been made between the lakes Wenern and Wettern, which is called the Western Göta Canal; and another canal between Lake Wettern and the Baltic, which is called the Eastern Göta Canal. The Western Göta Canal is about 20 miles long, exclusive of Lake Viken, which is the summit-level of the line, 296 feet above the sea, 8 feet above Lake Wettern, and 152 feet above Lake Wenern. As the descent to Lake Wenern is so great, this line has required 24 locks. Lake Viken cannot supply so much water as is required for them, but to the north of it is Lake Unden, which is 87 feet higher, and discharges its waters into Lake Viken. The Eastern Göta Canal is about 64 miles long, inclusive of the lakes which it traverses, and which have been deepened to obtain the necessary depth for the vessels: it extends along the banks of the Motala eastward to its efflux from Lake Roxen, whence it continues in a straight line through the small lake of Asplangen (86 feet above the sea), and enters the Baltic, where it forms a considerable inlet, called the Släte Baken, two miles below Söderköping. The Eastern Göta Canal has 35 locks. The Göta Canal is 10 feet deep, 48 feet wide at the bottom, and 82 feet at the surface. These two canals were begun in 1810, and in 1830 the whole was finished, and the navigation opened. The width of Sweden near 58° 30′ N. lat., near which parallel the greater part of this inland navigation is situated, is about 200 miles. The navigation through the Göta-Elf, the lakes Wenern and Wettern, and the two Göta Canals, does not exceed 260 miles.

In the parallel of the northern part of Lake Wenern, but much more to the east, is Lake Hielmarn, which extends about 35 miles from east to west, and is about two miles wide at both extremities; but it enlarges in the middle to eight miles. The surface is 78 feet above the sea-level, and it covers an area of about 150 square miles. It communicates by a canal with the river Arboga, which runs north of the lake, and falls into Lake Mälaren. This canal, called the Hielmar canal, begins on the northern bank of the lake, and is about seven miles long: it has eight locks, and is six feet deep. Some time ago another canal was planned, which is to lead from the eastern extremity of Lake Hielmarn through Eskilstuna immediately to Lake Mälaren: we are not acquainted with the progress of this work.

Lake Mälaren differs greatly from all the other lakes of Sweden. It consists of many small lakes, united by short channels, which enclose islands. The number of the small islands is in some places very great. Hardly a clear sheet of water of a mile square can be found. From what may be called the main body of the lake several narrow arms branch off to the south and north, and penetrate to a great distance inland. One of them, which extends northward, is more than 25 miles long. All these numerous arms and branches are navigable for boats. If we consider the town of Stockholm to be built at the eastern extremity of the lake, its length exceeds 60 miles. It is nearly on a level with the Baltic.

The advantages of the navigation on Lake Mälaren have been increased by the Södertelge and Strömsholms canal. The Södertelge canal is a cut about two miles long, which unites one of the arms of Lake Mälaren, which penetrates several miles inland to the south, with a deep inlet of the Baltic, called the Järne (Yärne) Fiord. By means of this cut vessels of about 20 tons burden can reach the Baltic without passing through the long channels that lead to Stockholm and thence to the open sea. This canal is about 18 miles west-south-west of Stockholm. The Strömsholms canal joins the lake not far from its western extremity, and comes from the north. It leads to the interior of the region of the mines, and terminates in the lake of Barken, which is 327 feet above the sea-level. Its length, including the lakes Barken and Amänningen, which together occupy more than 20 miles, exceeds 50 miles. It can only be navigated by vessels drawing four feet of water, and has 25 locks.

The only navigable rivers in Sweden are those which have been rendered so by art. The rivers south of 60° have generally a short course, but north of 60° there are several which run above 300 miles, descending from the higher portion of the Kiölen range, and falling into the Gulf of Bothnia. Nearly all of them run from the north-west to south-east. The largest is the Dal-Elfven. [DALECARLIA, vol. viii., p. 289.] Farther north is the Liusnan or Liusne Elf, whose most remote branches originate on the southern declivity of Mount Sylfiellen. Its upper course is in the elevated valley of Herjedalen, and is very rapid. East of 15° E. lat. it descends into the lower country, forming numerous small cataracts. In the lower country it often extends to the width of two or three miles, so as to resemble a lake. This river falls into the Gulf of Bothnia south of the town of Söderhamn, after having run about 250 miles. Farther north the Gulf of Bothnia receives the Liungan Elf, the Indals Elf, and the Angerman Elf. [ANGERMANLAND, vol. ii., p. 18.] The rivers of BOTHNIA (vol. v., p. 255) are the Umea Elf, the Skelleftea Elf, the Pitea Elf, the Lulea Elf, the Calix Elf, and the Tornea Elf.

Climate.—The difference in the climate of various places in Sweden is chiefly to be attributed to the difference of latitude and elevation above the sea-level. The most northern point of the country lies 2½ degrees beyond the polar circle: the most southern is situated nearly 11 degrees to the south of it. A small portion of the country is so elevated that it is always covered with snow; and large tracts along the sea-coast are only a few feet above the sea. The elevation at which perpetual snow occurs is less as we proceed farther north. Near 60° N. lat. it is about 5600 feet, at 61° N. lat. 5400 feet, at 62° N. lat. 5100 feet, at 64°, 4650 feet, and at 71° N. lat. 2300 feet above the sea. The table-land of Smäland rises from 400 to 900 feet above the sea-level, and that of Jemtland is about 1100 feet. The inclined plain in the most northern district of Sweden rises near the boundary of Norway to 2000 feet above the sea. A part of Southern Sweden is also exposed to the influence of the Atlantic Ocean, which always has the effect of raising the temperature in winter, and of moderating the heat in summer. The following tables give the result of meteorological observations continued for many years, at ten places, which are at considerable distances from one another, and at different levels above the sea.

Table I., containing the Mean Temperature of five Places in Sweden, South of 60° N. lat., and of Edinburgh and London.

Months.	Lat. 57° 42′ Lund, altitude 60 feet.	Lat. 56° 53′ Wexiö, altitude about 590 feet	Lat. 57° 42′ Göteborg near the sea-level	Lat. 59° 23′ Carlstad altitude 175 feet.	Lat. 59° 20′ Stockholm, altitude 125 feet.	Lat. 55° 58′ Edinburgh, altitude 60 feet.	Lat. 51° 31′ London, altitude 150 feet.
December	+31·81°	+28·66	+31·42	+27·30	+27·18°	+39·72°	38·71°
January	28·51	27·86	29·90	25·60	24·32	36·32	36·34
February	29·10	28·18	30·11	28·42	25·86	38·48	39·60
March	32·36	30·68	31·25	31·26	29·58	41·56	42·01
April	41·29	40·80	43·84	39·64	36·76	44·14	47·61
May	51·69	53·12	53·02	50·30	48·26	49·36	55·40
June	60·31	62·90	61·04	59·34	57·62	56·30	59·56
July	63·25	66·01	62·05	63·44	63·16	59·00	62·97
August	62·61	63·12	61·28	60·80	60·80	56·66	62·90
September	56·17	51·50	55·90	54·18	53·65	55·32	57·70
October	47·01	44·48	48·66	41·48	44·18	45·14	50·79
November	37·90	35·42	33·65	38·65	35·38	41·54	42·40
Winter	29·51	28·23	31·51	27·11	25·82	38·27	38·22
Spring	41·78	41·53	43·74	40·40	38·20	44·95	48·34
Summer	62·07	63·45	62·13	61·16	60·43	57·32	61·74
Autumn	47·03	44·73	47·74	44·47	44·37	47·33	50·29
Annual mean	43·10	41·56	46·34	43·28	42·18	46·97	50·03

On comparing the climate of Edinburgh and London with that of five towns in Sweden, it appears that the mean temperature of the summer is greater in three of the Swedish towns than at London, and in all five greater than at Edinburgh. It is remarkable that the mean temperature of the summer of Wexiö exceeds that of Edinburgh by more than 6 degrees; though Wexiö is 500 feet above the sea, and nearly a degree farther north than Edinburgh. This is probably to be attributed to the dryness of the air on the table-land of Smaland during the summer. But the difference of the mean temperature of the winter is 10 degrees in favour of Edinburgh. Göteborg lies nearly 2 degrees nearer the pole than Edinburgh, but the mean annual temperature does not differ from that of Edinburgh much more than half a degree, though that of the winter differs nearly 8 degrees. In the winter the prevalence of northern and north eastern winds makes the inhabitants of Göteborg feel their more northern situation, whilst during the three other seasons the temperature is raised by the prevailing south-western and western winds, the temperature of which has been increased by passing over the Atlantic. It is generally observed that the weather is much more inconstant and wet on the western shores of Sweden, along the Skagerack and the Cattegat, than on the eastern shores along the Baltic, but not so subject to great changes. A closer inspection of the table would induce us to think that the prevailing opinion of the climate of Southern Sweden being a very cold one is not correct. The common opinion respecting the climate does not rest on continuous observation, but on single facts; and such facts would certainly lead us to think that the winters are very cold and the summers very hot in Sweden. On the 20th of January, 1814, the thermometer at Stockholm sunk to −26·6°, whilst at London and Edinburgh it never sinks to zero. On the 3rd of July, 1814, the thermometer at Stockholm was 96·8°, a degree of heat never experienced in the British Islands. But such extremes of cold and heat never last more than a few days.

Table II., containing the Mean Temperature of five Places in Sweden, North of 60° N. lat.

Months.	Lat 60° 34′: Falun, alt. 400 feet.	Lat. 62° 38′: Hernösand.	Lat. 63° 21′: Ostersund, alt. 1050 feet.	Lat. 63° 50′: Umeå.	Lat. 68° 30′: Enontekis, alt. 1440 feet.
December . .	+24·15°	+13·70°	+20·95°	+13·61°	+2·44°
January . .	18·63	16·32	9·25	11·60	0·12
February . .	23·30	17·04	15·30	14·93	1·92
March . . .	28·55	23·78	25·72	22·18	11·52
April . . .	37·41	31·04	33·00	33·98	26·15
May . . .	47·46	42·38	43·38	43·28	37·20
June . . .	67·30	53·30	54·48	51·50	49·02
July. . . .	60·35	58·64	57·90	61·24	58·10
August . . .	57·34	56·23	55·96	56·70	56·72
September . .	50·62	47·48	45·24	47·66	42·06
October. . .	43·68	39·24	39·40	38·25	27·45
November . .	30·22	28·50	29·04	27·10	11·75
Winter . . .	22·04	17·35	15·17	13·41	1·49
Spring . . .	37·82	35·73	34·03	33·15	24·96
Summer . . .	58·33	56·06	56·11	57·48	54·61
Autumn . . .	41·51	38·41	37·91	37·67	27·07
Annual Mean .	39·92	36·36	35·80	35·42	27·04

The difference in the mean temperature of the summer in these five places lies within four degrees, though the most southern and the most northern are nearly eight degrees of latitude distant from one another, and the most northern is more than 1000 feet more elevated above the sea-level. This fact is to be attributed to the long stay of the sun above the horizon in that season, which, at Enontekis, lasts more than three weeks. This circumstance enables the inhabitants of these northern countries to cultivate a few plants which require a sudden heat, as barley, which is sown and reaped within seven weeks. The winters however are extremely cold. Forsell observes that north of 61° the quicksilver frequently freezes, which indicates that the thermometer descends at least 40° below zero. The heat increases all over Sweden most rapidly in the two months preceding the summer solstice, and we find that the difference between the mean temperature of April and June in the south of Sweden generally amounts to twenty degrees, and in the northern somewhat more. In the British Islands this difference does not amount to more than twelve degrees. On this fact is founded the observation, made by almost every traveller, that in Sweden there is hardly any spring; the hot summer almost immediately follows the cold winter. The same observation however might also be made respecting the winter following the summer, as the temperature decreases nearly in the same ratio in October and November.

The annual quantity of rain is not known for the northern provinces, nor for the districts in the interior of the peninsula. In the low country bordering on the Baltic it amounts to between 21 and 22 inches, which is a less quantity than falls at London; but the snow is probably not included in this account. The number of rainy days in the year is said to be 149 in the southern districts. The prevailing winds blow between south-west and north-west. The number of days on which the wind blows from south-west is 77; on 43 it comes from the west, and on 56 from north-west. From the north the wind blows 13 days; from north-east 63 days, from east 14 days, from south-east 38, and from south 18 days. The number of days which are quite calm is 36 These observations respecting the winds were made at Göteborg, on the west coast of Sweden.

As to the effect of the climate on cultivation, it is observed that at Enontekis (68° 30′ N. lat.) only barley and turnips succeed; and that in thirty years only nine crops have paid for the labour. Rye cannot be grown with advantage north of 66° N. lat.; and so far also the cultivation of hemp extends. Oats cease to ripen north of 64°, and up to this latitude wheat is cultivated in a few spots, but in general it cannot be grown with advantage north of 62° N. lat. Flax is grown as far north as 64° N. lat., but it does not ripen to seed north of 63° N. lat. Tobacco rarely succeeds north of 61°. Potatoes are cultivated as far as 66° N. lat., but cabbages only to 64° N. lat. Hops grow as far as 62° N. lat. Cherry-trees are met with as far north as 63°, but other fruit-trees rarely beyond 60° N. lat. In the plain of Scania mulberry-trees, chestnut-trees, and walnut-trees are planted, and the fruit ripens.

The pine, fir, and birch extend to the most northern parts of Sweden; and near 68° N. lat. there are fine trees. Alders are found up to 63°, ash and willows to 62°, and elm and lime trees to 61° N. lat. The oak-tree grows wild between 60° and 61° N. lat., but some planted trees are found farther north. Beech does not grow wild north of 57°, and so far it forms forests; but farther north only single beech-trees occur.

Pine-trees cease to grow at an elevation of 3000 feet below the snow-line; and lakes which approach nearer to the snow-line do not contain the Salmo thymallus and the Salmo lavaretus. Bears are not met with above 3000 feet; and at that height barley ceases to ripen. The few families which live nearer the snow-line live on the produce of their fisheries and of a few cattle. Men do not fix their permanent dwelling nearer than 2500 feet to the snow-line. Firs are only found at 2600 feet under the snow-line, but full-grown birch within 1800 feet. In the lakes which occur at such an elevation only the Salmo alpinus is found. Some bushes and the dwarf birch grow at 1200 feet below the snow-line; and so far the Arctic bramble (Rubus arcticus) is found: but above them trees and bushes cease to grow, and the mountains are covered with brown plants and lichens. The Laplanders advance with their reindeer in summer to 750 feet below the snow-line.

Agriculture and Productions.—The climate and soil are less favourable to the growth of grain in Sweden than in most other parts of Europe. It is stated that in seven years one year occurs in which the crops entirely fail; that in three the produce is indifferent, and in three rather plentiful. Formerly Sweden did not produce so much corn as was required for home consumption, and considerable quantities were imported. Between 1777 and 1790 the quantity imported amounted to nearly 400,000 quarters; and even between 1810 and 1816 to 150,000. The great disproportion between the produce of the crops and the consumption induced government to make every effort to extend cultivation, which has been accomplished by settling such portion of the landed property of the crown which seemed to be fit for cultivation, and by inducing the agricultural inhabitants to build their dwellings in the centre of the pieces of ground which had fallen to their share in the new distribution of the lands. When the agriculturists lived in villages, the land was divided among the proprietors, so that each of them possessed a long narrow piece of ground, the farthest extremity of which was frequently two or three miles from the dwelling of the farmer. The fields which were at such a distance were of course neglected, though the soil was not inferior to that of the fields near his home. Government induced and partly obliged the farmers to divide these fields, so as to form more compact estates, in the middle of which the premises of the farmers were erected. This change, more than any other, has enabled Sweden to produce as much corn as is required for its consumption. The principal objects of cultivation are wheat, rye, barley, oats, mixed grain, and peas. According to the estimates of Forsell, wheat yields 6½, rye 5½, barley not quite 5, oats 3½, mixed grain 4, and peas 4⅔ times its seed. This produce coincides nearly with that of the northern countries of Germany and with that of Poland. Though the whole produce between 1805 and 1828 increased by 42 per cent., it would not even now be sufficient for home consumption if the cultivation of potatoes had not greatly increased. In 1805 only about 200,000 quarters of potatoes were grown, but in 1828 the potato crop was nearly 1,800,000 quarters.

Other objects of cultivation are hemp, flax, and tobacco; buckwheat and carraway-seed are also grown; and hops and madder. Nearly all the kitchen vegetables grown in England are cultivated in the southern provinces of Sweden, and most of them with tolerable success. Cherries, apples, and pears are abundant only in the southern districts; cranberries and other berries abound in the northern districts.

The forests are very large, sometimes extending 80 miles in length, with a width exceeding 25 miles, as the great forest which covers the mountains between the table-land of Jemtland and the valley of Herjedalen. But a great portion of the northern provinces (north of 64° N. lat.) is destitute of trees. Nevertheless the woods cover more than one-fourth of the surface, or 48,500 square miles; but they contain a comparatively small number of timber-trees. In most parts the soil does not favour their growth, and only small trees occur, and at the distance of many feet from each other: the bushes and underwood in many places occupy the intervals, and in other places there is no underwood. Accordingly the export of timber, though considerable, is not in proportion to the immense extent of the woods. But these forests supply firewood, of which a great quantity is consumed, as Sweden has no coal. Large quantities of charcoal are also used in the mines and in the manufactures. In some parts, especially towards the north, tar and pitch are extracted, chiefly from the roots of pine-trees, and are minor articles of export. Several kinds of coniferous trees and birch compose the greater part of these forests. Oak and beech form forests of small extent, but only in the southern districts. The immense tracts of country which are still uninhabitable, are generally used as pasture-ground, though it is of a very indifferent description; the domestic animals must be kept in stables from four to six or seven months, and their number is consequently limited by the extent of the meadows. Many tracts, at present used as meadows, could be cultivated, but it is found more advantageous to use them for making hay. As the pasture-grounds are in general very indifferent, the animals are small, especially the horses. Cattle and sheep are the most numerous, but the former are of small size, and the wool of the sheep is coarse. Some attempts have been made in Scania to cross the sheep with merinos. In the northern districts (north of 64°) reindeer are kept by the Laplanders, who bring them in summer to the most elevated parts of the Kiölen range, where they feed on the reindeer moss (Lichen Islandicus), and in summer they pasture them on the low tracts near the Gulf of Bothnia. Wild animals are very numerous, especially in the northern parts, but some of the larger size begin to be scarce, as bears and beavers. A few wild reindeer are still found in some places. Wolves, lynxes, gluttons, foxes, hares, squirrels, martens, and others are common. Lemmings sometimes come down in large numbers from the Kiölen Mountains, and lay waste the low country. Elk and deer are found in some of the large forests. The largest of the wild birds are eagles, capercailzies, and woodcocks. The seas of Sweden contain abundance of fish. Formerly large shoals of herrings came to the Cattegat, and in the latter half of the last century there was a very extensive fishery on the west coast of Sweden, but it has dwindled away, as the herrings no longer appear on that coast. It is stated that 88 different kinds of salt and fresh-water fish are brought to the markets of Göteborg, among which the turbot is common. There are also oysters and lobsters. The fishery in the Baltic gives subsistence to a great number of families. A smaller kind of herrings, called strömings, is caught in the summer, along the whole extent of the east coast, from the Quarkan to the peninsula of Scania. This fish is very numerous, and is prepared in different ways: it is rarely exported, but forms a large branch of internal commerce. Salmon is caught abundantly in almost all the rivers. The Salmo thymallus and the Salmo lavaretus abound in the lakes.

Sweden is rich in minerals. Gold is found on the table-land of Småland, at Adelforss, and was worked to the commencement of the present century, but the produce was so small, and the expenses of working the mine so great, that it has been abandoned. Silver is worked at Sala, in Westeras Län, and at some other places, and in Falu Län; but the produce amounts only to about 3000 marcs annually, of which the mines of Sala alone yield 2500 marcs. The expenses of working these mines are so great, that, according to Forsell, some disposition has lately been shown to abandon them. Copper is more abundant. The annual produce of the copper-mines amounts to nearly 1000 tons. The richest mines are those at Falun, in Falu Län, which annually produce 682 tons: next to them are those of Otvidaberg in Linköping Län, with an annual produce of 176 tons. Other copper-mines are worked in Westeras, at Riddarehytta, in Oresund near Mount Areskuta, and in Orebro near Hokanbo, and at a few other places; but their produce is small. The lead-mines, which are worked in Westeras, and in Falu, produce annually about 44 tons. Iron-ore is found in nearly every district of Sweden, and there is no part where it is not worked more or less, with the exception of the plain of Scania, where it seems that no iron-ore exists. The richest iron-mines are worked in that part of Sweden which has been noticed under the name of the region of the mines. But there are other places which contain inexhaustible layers of iron-ore, which cannot be worked on account of the access to them being difficult, or their being situated in a country destitute of fuel. This is the case with the mountains near Gellivare in Pitea Län, which are composed entirely of iron-ore, containing from 70 to 80 per cent. of metal, and which could furnish the whole world with iron for many centuries; but they are far from the sea, in a country nearly uninhabited, and almost destitute of fuel. The large mass of iron-ore in the Taberg, on the table-land of Småland, contains only 25 per cent. of metal, and it is too poor to be worked alone, though the metal is of good quality. The best iron is obtained from the mines of Dannemora in Upsala Län, and is well adapted for making steel. Nearly the whole of the produce, amounting annually to more than 3000 tons, goes to England, where it is called Oregrund iron, being shipped at the town of that name. But the largest quantities of iron are produced in Carlstad, Orebro, Gefle, Falu, and Westeras. The iron goes from Carlstad to Göteborg, but from the other provinces to Stockholm, and from these two places it is sent to foreign countries. The annual produce of all the iron-mines of Sweden amounts to more than 67,000 tons of bar-iron. In Orebro Län are rich mines of cobalt, which yield annually more than 600 tons; others are found in Calmar and Nyköping Län, but their produce is not great, as all the cobalt-mines of the kingdom do not produce more

than 730 tons. At some places alum and vitriol are obtained, but only in small quantities. Coal of an inferior kind, called brown coal, is worked near Cape Kullen in Scania; but only to a small amount, as these mines are near the sea, where English coal of a superior quality may be obtained nearly for the same price. Porphyry is got at Elfvedal, in the upper valley of the Dalelfven, north-west of Lake Siljan; and marble in the Kolmorden ridge, north of Norrköping, and in a few other places.

Inhabitants.—The bulk of the population are Swedes, a nation of Teutonic origin, and resembling the inhabitants of Great Britain, except that they are of a somewhat more slender make and fairer. They are distinguished by their predilection for scientific researches and a spirit of enterprise and activity. Besides the Swedes, there is a small number of Fins and Laplanders. The Fins [FINS] are numerous on the banks of the Tornea Elf, near the boundary of Russia, and excel in the rearing of cattle and the management of dairies. There are some families of Fins more to the south, especially in the woody country near the boundary-line of Norway, south of 61° N. lat., to which place they were transplanted more than 200 years ago by Charles IX. They rarely intermarry with the Swedes, and they preserve their habits and language.

The Laplanders were formerly in possession of all Lapland [LAPLAND], but many Swedes and Fins have settled among them. They call themselves Sami, and their country Samilanda. Though their language proves that they are only a branch of the Finnish nations, they are distinguished from them by the form of their body and their mode of life. Their stature is short, varying in general between four and five feet; which seems to be the effect of the cold, to which they are exposed in winter in their miserable huts: for in the richer families, who have more comforts and protect themselves better from the severity of the weather, there are persons who measure five feet six inches. Their complexion is a dirty yellow, which is partly to be attributed to the smoky huts in which they pass the winters. Their face is generally broad and their nose short; the hair is rather black; the eyes are brown, narrow, and lengthened; and the mouth small. They are not strong, but they are very active, and of a cheerful disposition. A few families obtain their livelihood by fishing in the lakes and rivers, but the greater number live on the produce of their herds of reindeer, which supply the Laplanders with food, dress, and articles of exchange. They live on the milk and flesh of the reindeer, convert their skins into dresses, and sell their smoked flesh, and especially their tongues, which are considered a great dainty. These animals are also used in drawing the sledges. The Laplanders live only in the country north of 64° N. lat.: in winter they come with their herds to the lower country near the Gulf of Bothnia, and in summer they migrate to the Kiölen mountains. There are a few families south of 64° N. lat., who live the whole year near the mountains which are connected with Mount Areskuta and Mount Sylfiellen, and in summer remove to the higher part of the range. It is stated that the whole number of Laplanders in Sweden does not exceed 7000 individuals.

Population.—The population of Sweden in 1839 was 3,109,772, so that there were about 18 persons to each square mile. But the increase of the population, especially of late years, has been so great that Sweden must be considered as a newly settled country, when it is considered that the whole increase is the effect either of the extension or the improvement of agriculture. The following table shows this increase for the last 85 years:—

Population of Sweden from 1751 *to* 1839.

Year.	Population.	Increase.	In what Period.	Annual Increase.
1751	1,785,727	..		
1760	1,893,246	107,519	9	11,946
1772	2,012,772	119,526	12	9,960
1780	2,118,281	105,509	8	13,189
1785	2,142,273	23,992	5	4,798
1790	2,150,493	8,220	5	1,644
1795	2,280,441	129,948	5	25,989
1800	2,347,303	66,862	5	13,372
1805	2,412,975	65,672	5	13,134
1810	2,377,851	35,123 dec.	5	7,025 dec
1815	2,465,066	87,215	5	17,443
1820	2,584,690	119,624	5	23,925
1825	2,771,252	186,562	5	37,312
1830	2,888,082	116,830	5	25,366
1839	3,109,772	221,690	9	24,632

From this table it appears that in 85 years the population has increased by 1,324,045 individuals, or nearly three-fourths of the population of 1751, though the effect of the continental system of Napoleon on the welfare of Sweden is perceptible in the decrease of the population between 1805 and 1810. The great increase which is observed in the last twenty years is mostly to be attributed to the new system of farms, which has been already noticed. Between 1820 and 1830 the population increased 293,392 individuals, or 11·3 per cent. In Scotland the increase between 1831 and 1841, according to the recent census, has been only 11·1 per cent., though Sweden has not experienced any increase in its manufactures, which has certainly been the case in Scotland, as is proved by the increase of the population in Glasgow, Dundee, Paisley, and other manufacturing towns.

The population is very unequally distributed. The most northern district, the Län Pitea, contains only 1¼ individuals to a square mile; the most southern, the Län Malmö, has more than 122 on the same extent of country. The following table shows the differences in the area and population of the different läns:—

Population of the different Districts of Sweden in 1839.

Names of the Districts.	Extent in square miles.	Population in 1839.	Number of Persons on each square mile.
City of Stockholm	..	83,885	..
Stockholm Län .	2,918	111,342	38·3
Upsala . .	2,095	85,393	40·8
Westeras . .	2,667	92,411	38·4
Nyköping . .	2,512	113,752	45·3
Linköping . .	4,263	200,588	44·4
Jönköping .	4,302	148,595	34·5
Wexiö . .	3,795	118,309	31·1
Calmar . .	4,267	179,300	42·0
Wisby . .	1,230	42,580	31·6
Carlscrona . .	1,170	93,849	80·2
Christianstad .	2,438	162,809	66·5
Malmö . .	1,785	218,074	122·2
Halmstads . .	1,904	94,832	49·8
Göteborg . .	1,909	164,598	81·4
Wenersborg .	5,047	218,698	43·3
Mariestad . .	3,324	179,449	53·9
Orebro . .	3,261	125,393	38:4
Carlstad . .	6,960	192,879	27·7
Falu . . .	12,285	141,208	11·3
Gefle . . .	7,577	109,382	14·4
Hernösand .	9,521	85,242	89·0
Ostersund . .	19,175	45,517	2·4
Umea . .	29,445	55,256	1·9
Pitea . .	33,104	46,422	1·4
	166,045	3,109,772	18·7
Add the surface of the four great lakes of Southern Sweden .	3,590		
Total	169,635		

Historical and Political Divisions and Towns.—Sweden is divided into three great sections, of which the most southern is called Götaland or Göta Rike, the central section more properly Sweden or Swea Rike, and the northern Norrland. Each of these great sections was in course of time subdivided into several provinces, according as it appeared requisite for the purposes of administration. But this division into provinces being found inconvenient, another was adopted, by which some of the provinces were divided into two or three districts; whilst, on the other hand, in a few cases two provinces of the older division were united into one administrative district: these new districts are called läns. We shall give both the older and the more modern divisions.

The towns of Sweden are very small: many of them in England would hardly be called villages. They amount to

88, but more than 30 of them have not 1000 inhabitants, and a few have only from 200 to 300. There are only four towns whose population in 1839 exceeded 10,000, and only thirteen which were inhabited by more than 4000. Most of the smaller towns are inhabited by farmers, who have their small estates contiguous to the town, and a few tradesmen and mechanics.

I. Götaland, or Göta Rike, comprehends nearly the whole country south of 59° N. lat., and also that portion of the region of the mines whose drainage runs southward into Lake Wenern. It was formerly divided into ten provinces, and now contains 13 läns. The island of Gothland constitutes part of it.

1. Skane, generally called in England Scania or Schonen, extends over the Plain of Scania, and the high ground which lies north of it, comprehending also a small portion of the table-land of Smäland. It is the most fertile and most populous part of Sweden, rich in agricultural produce and all kinds of domestic animals. It is divided into two läns, Malmö Län and Christianstads Län.

a. Malmö Län extends over the south-western and best cultivated portion: it contains three towns with more than 4000 inhabitants, Malmö with 9720, Lund with 4970, and Ystad with 4325 inhabitants. Ystad, which is on the south coast, has an indifferent harbour, and is the place from which a regular communication is maintained with Germany, especially Stralsund in Pomerania. Steam-boats are now used. It contains some dye-houses and tanneries. Landscrona, built on the shores of the Oresund, is a fortress, and has a good harbour. It has a population of 3975 inhabitants, and a few tanneries, and soap and sugar houses. Helsingborg is situated at the narrowest part of the Oresund, opposite Helsingör in Denmark, and has a harbour, 2854 inhabitants, and some manufactures, on a small scale, of hats, ribands, and cast-iron pots. To the north of this place, at Höganas, about five miles from Cape Kullen, is the only coal-mine in Sweden. The small island of Hween, in the Oresund, on which are still some ruins of the observatory of Tycho de Brahe, belongs to this län.

b. Christianstads Län contains the eastern and northern and less fertile part of the plain of Scania, and a small portion of the table-land of Smäland. The capital is Christianstad, with 4710 inhabitants. Towards its southern extremity, near the boundary of Malmö Län, is a considerable alum-work, at Andrarum.

2. Blekinge contains the whole maritime region of Blekinge, with a narrow strip of the table-land of Smäland: it is generally fertile, and has good fisheries along the coast and in the rivers. It forms only one län.

c. Carlscrona Län has for its capital Carlscrona, with 12,850 inhabitants. The most commercial town is Carlshamn, with 4196 inhabitants, and a small but good harbour. Sail-cloth, starch, and tobacco are made for the consumption of other places. Vessels are built here.

3. Smäland comprehends nearly the whole of the table-land which bears its name, and the maritime region of Smäland. It is divided into three läns, Calmar, Wexiö, and Jönköping.

d. Calmar Län comprehends all the maritime region and a small portion of the table-land. It is rather fertile in agricultural productions, and has good forests of timber-trees. There are mines of iron, which yield a considerable produce; cobalt and alum are also got. It exports timber and the produce of the mines. Calmar, the capital, has 5920 inhabitants. Westervik, farther north, has a good harbour, and above 3000 inhabitants: it exports timber and the produce of the cobalt-work in its vicinity. Vessels also are built. The island of Oland, which is included in this län, is fertile, but it contains no town. The population is about 35,000 individuals.

e. Wexiö Län extends over the southern and lower portion of the table-land of Smäland. It is a poor country, and less populous than any other portion of Götaland. There are some mines of iron, but the produce is small. The capital, Wexiö, has 1844 inhabitants. Paper and hats are made.

f. Jönköping Län extends over the northern and more elevated portion of the table-land: the soil is not much better than that of Wexiö Län, but the iron-mines are more considerable, especially those at the Taberg. The capital, Jönköping, is built at the southern extremity of Lake Wettern, and in modern times an artificial harbour has been made to protect the vessels which navigate the lake against the gales and swell. It has 4215 inhabitants, and a considerable commerce with the countries that surround the lake. There are an arsenal and a manufacture of arms. The gold-mine of Adelforss is within this län.

4. Halland comprehends the maritime region of that name, and the western declivity of the table-land of Smäland. It forms one län.

g. Halmstads Län has good forests and fisheries, especially in the rivers; the salmon is considered the best in Sweden, and forms a considerable article of export to other provinces. The capital, Halmstad, has 1853 inhabitants, and exports timber, pitch, tar, and the produce of the mines of Jönköping Län. Woollen stuffs are manufactured.

5. Western Götaland comprehends the north-western portion of the table-land of Smäland, and its declivity in that direction to the banks of the Göta Elf, and also the plain south of Lake Wenern. The whole of Mariestad Län, the largest part of Wenersborg Län, and a small part of Göteborg Län are in this province.

h. Mariestad Län comprehends the greater part of the plain south of Lake Wenern, and is fertile, well cultivated, and populous. It has some iron-mines and alum-works at Mount Kinne Kulle. There are also some considerable glass-houses. The capital, Mariestad, is on the shores of Lake Wenern, and has 1573 inhabitants. Skara, in a very fertile district, has 1497 inhabitants.

i. Wenersborg Län extends over the western and smaller part of the plain south of Lake Wenern, the north-western part of the table-land of Smäland, and the eastern part of the valley of the Göta Elf. It contains the province of Dalsland. A part of it is fertile, but the remainder has an indifferent soil. It has some iron-mines, but the produce is not great. The capital, Wenersborg, is built near the efflux of the Göta Elf from Lake Wenern, and carries on a considerable commerce in iron. The population is 2500.

6. Bohusland extends over the western and more sterile portion of the rocky region. The inhabitants of the coast obtain their livelihood by fishing and gathering lichens, which are used as a dye-stuff. In the eastern parts are fertile spots and good pasture-grounds. It forms the greatest part of Göteborgs Län.

k. Göteborgs Lan comprehends Bohusland and a small portion of Western Götaland, which surrounds the capital. The last-mentioned district is rather fertile. The capital is Göteborg, with 19,800 inhabitants. Marstrand is built on a rocky island, about four miles from the continent: it has a good harbour, and is inhabited by fishermen. The population is 1113. Udevalla, built at the innermost recess of a deep inlet, has a good harbour, and exports timber. It has a manufacture of cables and a sugar-house. The population is 3917. Strömstad, near the boundary-line of Norway, has a harbour, and 1500 inhabitants, who are mostly occupied in fishing lobsters and oysters, which abound along this coast.

7. Dalsland is the smallest province of Sweden, and forms the northern part of Wenersborg Län. It comprehends the eastern and more fertile districts of the rocky region. The low tract along Lake Wenern is one of the most fertile districts in Sweden. In this province is the small-town of Amal, with 1457 inhabitants.

8. Vermland comprehends that part of the region of mines whose drainage runs into Lake Wenern, and extends northward to 61° N. lat. There are fertile tracts along the banks of the lake: the interior has an inferior soil, but is richer in iron-mines than any other province of Sweden. Their annual produce amounts to 12,500 tons, or nearly one-fifth of the produce of the kingdom. The iron is collected at Carlstad and Christinehamn, and hence sent to Göteborg by way of Wenersborg. From Göteborg this iron is exported to all parts of the world. Vermelands forms Carlstad Läns.

l. Carlstads Län has for its capital a town of the same name, built on the small island of Tingvalla, near the influx of the Klar Elf into Lake Wenern: it is the centre of a considerable commerce with all the mining districts of Vermland: the population is 3034. Christinehamn is situated at the most north-eastern angle of Lake Wenern, and exports iron and timber to Wenersborg and Göteborg: the population is 1759.

9. Eastern Götaland lies between lake Wettern on the west and the Baltic on the east, and contains the whole of the plain of Linköping, together with the higher grounds south and north of it. The plain is rich in agricultural produce: the higher grounds have considerable iron-mines, which

produce annually 1300 tons of bar-iron: there are copper-mines at Otvidaberg. The eastern part of the Göta canal traverses Götaland from west to east. It forms one län.

m. Linköpings Län: the capital of this län is situated in the centre of the province, about two miles south of Lake Roxen and the Göta canal: it is a pretty, well-built place, with a fine cathedral and a good grammar-school. It has some manufactures of wool, stockings, and tobacco: the population is 3710. Söderköping is situated on the Göta canal, about two miles from the place where it joins the Slåte-baken, an inlet of the Baltic: it is a small place, with about 1000 inhabitants. The largest place is NORRKÖPING, with 12,880 inhabitants. Wadstena is built on the banks of Lake Wettern, and contains 2188 inhabitants: much lace is made here, and some carpets and woollen cloth.

10. The island Gothland [GOTHLAND] forms

n. Wisby Län.

II. Sweden, properly so called, or Swea Rike, comprehends the central provinces of the kingdom, which lie chiefly between 59° and 61° N. lat. It extends over the country surrounding the lakes Mälaren and Hielmarn and over the basin of the Dalelf. It was formerly divided into five provinces, and contains six lans.

11. Nerike, the most south-western part of Swea Rike, is composed of a portion of the region of mines, and of another belonging to the central agricultural region. The mines occupy the northern, and the agricultural district the southern part of the province. Besides very extensive and numerous iron-mines, which yield an annual produce of nearly 9000 tons of bar-iron, it has mines of copper, cobalt, alum, brimstone, and vitriol. It forms one län.

o. Orebro Län: the capital, also called Orebro, is built near the western extremity of Lake Hielmarn, and is one of the most commercial places in the interior of Sweden: the mining districts north of the town bring their produce to this town, and take in return corn, and manufactured articles and foreign goods, which are brought to Orebro by Lake Mälaren and the Arboga canal. The population is 4198. Woollen stuffs, wax-cloth, and arms are manufactured at Orebro. Askersund, a small town at the northern extremity of Lake Wettern, has 871 inhabitants, and a harbour, the only natural one on the banks of this lake.

12. Södermanland, or Sudermania, comprehends the country between the Kolmoren ridge on the south, and the lakes Hielmarn and Mälaren on the north; and contains the best part of the central agricultural region: much wheat is grown. It has some mines of iron, and marble of good quality is worked in the Kolmoren range. The western part of this province forms Nyköpings Län, and the eastern, which is much smaller, constitutes a part of Stockholms Län.

p. Nyköpings Län has a capital of the same name, which is built at the innermost recess of a short inlet of the Baltic; forming a harbour, which is choaked up with sand, and only admits small vessels. It has some manufactures of wool, linen, silk, tobacco, stockings, pins, paper, and brass. Cannons are also cast. It exports iron, timber, and brass; the population is 3000. Eskilstuna, which is situated between the eastern extremity of Lake Hielmarn and Lake Mälaren, is the most important manufacturing place in Sweden for iron. Arms and cutlery are made to some extent. There is also a copper-work. It is a thriving place, and contains above 2500 inhabitants.

13. Upland extends from the northern banks of Lake Mälaren to the banks of the Dalelf along the Baltic, and about 60 miles inland. It comprehends the largest portion of the central agricultural region, and produces much rye and barley. It has also considerable iron-mines, the annual produce of which amounts to 4700 tons: the mines of Danemora yield iron of the finest quality. Upland is divided into two nearly equal parts, of which the western forms Upsala Län, and the eastern belongs to Stockholms Län.

q. Stockholms Län comprehends the eastern half of Upland, and also the eastern districts of Södermanland. The capital is STOCKHOLM, the capital of the kingdom, with 83,885 inhabitants. Södertelge, a small town with 1065 inhabitants, lies west-south-west of Stockholm, on the Södertelge canal: it has some commerce in provisions. Norrtelje, at the innermost corner of an inlet of the Baltic, has 1036 inhabitants, some commerce in grain, and some cloth manufactures. Oregrund, near the northern extremity of the Län, has a good harbour, in which the produce of the iron-mines of Danemora is shipped to England: the population is 671. Sigtuna, a small place with 586 inhabitants, on an arm of Lake Mälaren, is remarkable for the antiquities in its vicinity.

r. Upsala Län has for its capital the town Upsala [UPSALA], with 4897 inhabitants. Near Löfsta, towards the northern part of the Län, there are extensive iron-works.

14. Vestmanland, west of Upland and east of Nerike, contains a small part of the central agricultural region, and a larger part of the region of mines. The iron-mines yield an annual produce of more than 7000 tons. At Sala there are the richest silver-mines in Sweden. There are also copper and lead mines, but their produce is not great. This province forms Westeras Län.

s. Westeras Län has obtained that name from its capital, Westeras, which is built on an arm of Lake Mälaren, and carries on a considerable commerce in iron. It has 3344 inhabitants, and manufactories of tobacco and some dye-houses. Sala, north of Westeras, has 2916 inhabitants: in its vicinity are the silver-mines. Arboga, on the river Arboga, which begins to be navigable for river boats at that place, has some commerce in iron and grain, and 1747 inhabitants. Strömsholm, a royal palace, is built on the banks of Lake Mälaren, south-west of Westeras, where the Strömsholms Canal joins the lake.

15. Dalarne, or Dalecarnia, lies entirely within the region of the mines, with the exception of the northern part, which belongs to the southern mountain region. [DALECARLIA, vol. viii., p. 289.] It constitutes Falu Län.

t. Falu Län contains Falun [FALUN], with 4050 inhabitants; and Hedemora, a small town situated in a fertile district, with 1033 inhabitants.

III. Norrland extends over the three mountain-regions, with the exception of a part of the southern, which is included in Dalecarlia, and forms part of Swea Rike. It is composed of eight provinces, which form five Läns.

16. Gestrikland is situated within the region of the mines, of which it constitutes the most north-eastern portion. This is the most northern part of Sweden in which wheat is grown to any extent. It has good forests and mines, and forms the southern part of Gefle Län.

17. Helsingland, north of Gestrikland, within the southern mountain-region, produces rye and barley, and has good forests and mines. It forms the northern part of Gefle Län.

u. Gefle Län is composed of Gestrikland and Helsingland, and has rich iron-mines which yield an annual produce of more than 9000 tons. Flax is cultivated on a large scale, and exported to a considerable amount, though more linen is manufactured here than in any other part of Sweden. The forests supply other articles of export. Gefle, the capital, is built on the banks of a small inlet of the Gulf of Bothnia, which forms a good harbour. It is one of the best-built towns of Sweden, has 8200 inhabitants, and several good institutions for instruction, among which is a school for navigation. The commerce is considerable, and 76 vessels, with an aggregate of 15,000 tonnage, belong to the town. The exports consist of iron, timber, tar, flax, and linens; and the imports principally of corn and salt. It has some sugar-houses, and manufactures of sail-cloth, linens, and tobacco. Many vessels are built; and some families obtain their living by fishing. Söderhamn, at the extremity of a narrow inlet of the Gulf of Bothnia, has 1629 inhabitants, and exports butter, flax, and linens. Sail-cloth and linens are manufactured. Hudvicksvall, on a tolerably wide inlet of the Gulf of Bothnia, has 1877 inhabitants, and exports timber, flax, linens, and butter.

18. Medelpad, and

19. Angermanland, form

v. Hernösand Län, of which a description is given under ANGERMANLAND (vol. ii., p. 18).

20. Herjedälen consists only of the elevated and narrow valley of the upper course of the Ljusnan Elf, and extends to the declivity of Mount Sylfiellen. It has some iron-mines, and forms part of Oresunds Län.

21. Jemtland contains the table-land which derives its name from it, the upper valley of the Ljungan Elf, which lies south of it, and a large mountain-tract which lies north of the table-land, and contains the upper valleys of the rivers Indals and Angerman. No iron-mines are worked, but there is a copper-mine at the base of Areskuta. Agriculture is followed only on the lower part of the table-land, near the large lake called Störsiön. It is a part of Oresunds Län.

w. Oresunds Län, consisting of the provinces of Herjedälen and Jemtland, has for its capital the town of Ostersund, a small place with 418 inhabitants, and situated on the eastern banks of Lake Störsion.

22. Westerbotten, and

23. The Lapmarks, viz. Asele, Umea, Pitea, Lulea, and Tornea Lapmark, constitute the two läns of

x. Umea and

y. Pitea, of both of which a full account is found under the heads of Bothnia (vol. v., 255) and Lapland (vol. xiii., 329).

Manufactures.—Manufacturing industry has made no great progress in Sweden. The annual produce of the manufactures of the kingdom, in 1831, amounted only to 9,699,456 Swedish dollars, or 751,898*l*. The most important were those of woollen cloth and other stuffs, which amounted to 2,821,284 dollars, or 218,704*l*. The largest cloth manufactures are in Norrköping and Stockholm. A part of the material, to the value of 259,418 dollars, or 20,100*l*., was imported from foreign countries. Next to the woollen manufactures, if the value of the produce alone is considered, were the sugar-houses, the produce of which amounted to 1,813,069 dollars, or 140,548*l*. The largest manufactures of this description are at Göteborg. Tobacco is manufactured in many places, and at Norrköping on a large scale: the whole produce amounted, in 1831, to 817,225 dollars, or 63,351*l*.: a considerable portion of the material is imported. Next in importance are the paper manufactures which, in 1831, produced 517,215 dollars, or 40,094*l*. The largest establishments of this kind are in Christianstad Län and in Falu Län. Tanning is perhaps the most important branch of manufacturing industry. Though the produce of the tanneries, according to the published accounts in 1831, amounted only to 502,993 dollars, or 38,992*l*., it must be remembered that this quantity was only made in large establishments, where the leather is prepared in the English way; but there are tanneries in most of the towns, the produce of which is not included in the account. The largest manufactures of this description are at Stockholm. A small portion of the material was imported. The produce of the glass-houses amounted, in 1831, to 298,268 dollars, or 22,424*l*. The largest glass-houses are in Mariestad Län. The cotton manufactures have decreased, partly on account of the larger importation of English cotton goods, and partly because the inhabitants buy cotton-twist, and manufacture cotton-cloth in their houses. In 1831 the produce of the manufactures both of cotton-cloth and calicoes amounted to 330,643 dollars, or 25,624*l*. But the produce of the cotton-spinning establishments is considerable, and has been much increased by the erection of two or three manufactories within the last ten years. The produce of the silk manufactures, in 1831, amounted to 509,589 dollars, or 39,503*l*. All manufactures of this description are at Stockholm or in the neighbourhood. There are two manufactures of chinaware, the produce of which, in 1831, amounted to 161,243 dollars, or 12,500*l*. The manufactures of cast-iron yielded a produce of 155,512 dollars, or 12,055*l*.; but it was observed that a considerable number of small establishments, in which iron was cast, existed all over the mining districts, the produce of which was not known. Sailcloth was made, especially in Göteborg and its vicinity, to the amount of 111,555 dollars, or 8,647*l*. The soap-houses produced, in 1831, to the value of 104,800 dollars, or 8,124*l*.; and the oil-mills to the amount of 103,788 dollars, or 8,046*l*. The manufactures of watches, ribands, wax candles, and vinegar were inconsiderable. The most considerable branch of manufacturing industry, that of linens, is not included in this account. Linens are extensively manufactured in several parts of the kingdom, especially in the hilly portion of Wenersborg Län, where the produce was estimated, in 1831, to amount to 2,250,000 ells, or more than 2,000,000 of yards. Great quantities of linen are also made in Hernösand, Gefle Län, Colmar, and Halmstad Län. The whole produce of this branch of industry, which is carried on in the houses, is stated to amount to between four and four and a half millions of yards. Another important branch of industry, not included in the account, is the building of vessels, which is carried on to some extent in most of the harbours of the Baltic. No account is also taken of the produce of the numerous distilleries and breweries. When all these branches are added, it may be conjectured that the total annual produce of the manufacturing industry of Sweden does not fall much short of 15 millions of dollars, or 1,169,000*l*.

Internal Commerce.—The internal commerce must be considerable in a country a great part of which, such as the mining districts, does not produce sufficient corn for the consumption, and must be supplied with bread from other parts of the country. Several other articles, as salt, must also be brought from remote places to the inland provinces. The manufactured goods, especially the linens of Wenersborg Län, which are carried to the most remote parts of the country, add also greatly to the internal commerce. This commerce is facilitated by the excellent roads, and in winter by the whole country being covered with snow for four or five months, which renders the conveyance of goods in sledges easy and expeditious. In summer, a like advantage is derived from the navigation of the sea, which washes most of the provinces. In the provinces which lie farther inland, there are large lakes and extensive canals, which render the transport of goods easier and less expensive. It is said that the number of vessels employed in the coasting trade to carry the goods from one port to another amounted, in 1831, to 1209, and that the aggregate burden was about 67,000 tons. The number of large river barges and boats which are used on the canals is much greater. The statements respecting the navigation of the canals give us some idea of the internal commerce of the country. In 1831 the Trolhättan Canal was navigated by 1604 barges of 40 tons burden and upwards, and by 363 barges of less than 40 tons burden, besides 377 large boats and 32 rafts. They brought to Göteborg large quantities of iron and steel, and timber in planks and boards; and they carried into the interior corn, whiskey, salt, herrings, sugar, butter, fish, wine, and some other articles. The navigation began on the 21st of April and closed on the 31st of December. Through the Arboga Canal there passed, in the same year, 129 barges of 12 tons burden and upwards, and 30 barges of less than 12 tons. They brought to Stockholm bar-iron, alum, and corn, and took to the interior salt, herrings and strömmings, whiskey, and some other articles. The navigation began on the 4th of May and closed on the 15th of November. The Strömsholm Canal is navigated by barges varying between 12 and 30 tons burden, of which 621 passed through the canal. They carried to Stockholm large quantities of bar-iron, and took to the mining districts corn, salt, and salt-fish, with some minor articles. The navigation began in May and closed in November. The Södertelge Canal was navigated by 1102 barges of more than 12 tons burden, and 491 barges of smaller size and boats. The total tonnage of these barges was 12,000. The navigation began on the 1st of May and closed on the 27th of November. The Göta Canal was navigated by 434 barges of more than 12 tons burden, and by 70 smaller vessels. The goods which they carried were of very different descriptions: the most important were iron, corn, herrings, salt, bricks and tiles, and whiskey. The navigation began on the first of May and closed on the 27th of December.

Navigation.—The Swedes are much given to a seafaring life. Their vessels visit most of the countries contiguous to the Atlantic, and they are also employed in the carrying trade between other countries, especially in the Mediterranean, and on the coasts of South America. The number of sea-going vessels amounted in 1832 to 1081, with a tonnage of 136,268. Of this number 406 smaller vessels, with a tonnage of 26,875, were employed in the coasting trade, in the navigation on the lakes of Wenern and Wettern, and in the fisheries. The remainder, 675 vessels, with a tonnage of 119,393, carried on the commerce and navigation with other countries. The largest amount of shipping is owned by the following twelve towns: Stockholm has 146 vessels, with 30,500 tons burden; Gefle, 76 vessels, with 17,712 tons burden; Göteborg, 72 vessels, with 16,960 tons burden; Wisby, 77 vessels, with 8495 tons burden; Calmar, 87 vessels, with 6912 tons burden; Westervick, 35 vessels, with 4142 tons burden; Carlshamn, 35 vessels, with 4135 tons burden; Sundsvall, 21 vessels, with 3910 tons burden; Carlscrona, 48 vessels, with 3442 tons burden; Malmö, 42 vessels, with 3325 tons burden; Hernösand, 25 vessels, with 2690 tons burden; and Udevalla, 12 vessels, with 2627 tons burden.

Foreign Commerce.—The commerce of Sweden may be called large when it is considered that a scanty population is dispersed over an immense tract of country. The value of the exports varies between ten and fourteen millions of dollars, or between 772,798*l*. and 1,081,965*l*.; and that of the imports between ten and fifteen millions of dollars, or

between 772,789*l.* and 1,159,196*l.* The imports sometimes considerably exceed the exports in value, but this is only the case when the crops have failed, and considerable quantities of corn are imported, which was the case in 1826 and 1827.

The most active commerce subsists between Sweden and the countries surrounding the Baltic, the Netherlands, Great Britain, France, and Portugal. The commerce with Spain and the states of Italy is less important. The commerce with Brazil is very considerable. The statements respecting the commercial intercourse of Sweden in 1831 are contained in the following tables:—

Table I., exhibiting the Value of the Goods imported into Sweden.

Names of Countries from which exported.	In Swedish vessels.	In foreign vessels.	Total.
Norway	£50,880	£68,515	£119,395
Russia	86,171	82,653	168,824
Prussia	5,596	6,782	12,378
German States, exclusive of Hamburg and Lübeck	8,017	495	8,512
Denmark . . .	70,834	18,455	89,289
Hamburg and Lübeck	155,950	500	156,450
Netherlands . . .	14,417	1,233	15,650
Great Britain . .	44,581	90,282	134,863
France	25,595	4,348	29,943
Spain	11,943	..	11,943
Portugal . . .	23,148	75	23,223
Naples and Sicily .	2,469	..	2,469
United States of N. America . . .	12,401	57,577	69,981
Brazil	104,283	3,539	107,812
	616,288	334,444	950,732

Table II., exhibiting the Value of Goods exported from Sweden.

Names of Countries to which imported.	In Swedish vessels	In foreign vessels	Total.
Norway	£12,908	£27,616	£40,526
Russia	10,882	59,797	69,679
Prussia	34,396	8,817	43,213
German States, exclusive of Hamburg and Lübeck	28,811	5,183	33,994
Denmark . . .	110,001	10,309	120,310
Hamburg and Lübeck	67,257	384	67,641
Netherlands. .	17,995	8,233	26,228
Great Britain . .	113,880	143,979	257,859
France	48,910	5,655	54,565
Spain. . . .	3,095	91	3,186
Portugal. . . .	44,047	12	44,059
Gibraltar. . . .	1,081	..	1,081
Sardinian States .	4,263	..	4,263
Tuscany	10,349	..	10,349
Naples and Sicily .	522	..	522
Austria	1,445	..	1,445
Algiers	402	..	402
Egypt	3,197	..	3,197
United States of N. America . . .	52,164	247,237	299,401
Brazil	26,255	..	26,255
	591,860	517,313	1,109,173

The principal articles of export from Sweden are iron and timber. Great Britain, France, and Portugal take large quantities of both articles; the United States of America and Prussia take only iron; the countries of Italy, timber; Norway takes a considerable quantity of iron, and sends fish in return. The intercourse between Sweden and Russia is of a peculiar nature. The two countries have nearly the same productions, and there would of course be very little commercial intercourse between them if Stockholm did not receive from Finnland three-fourths of the firewood which it consumes. Some years ago the Swedish legislature gave a considerable premium for firewood brought to Stockholm from the northern provinces, but it was found that the expense of conveying it to the capital was too great, and that the firewood thus imported could not enter into competition with that from Finnland. Finnland also exports a considerable part of its produce to Stockholm, as meat, butter, cheese, bacon, flour, hides, pitch, and tar. The intercourse with the other provinces of Russia is inconsiderable.

The other articles of export, besides iron and timber, consist of copper, cobalt, and alum, of tar, pitch, hemp, oil, paper, tree-bark, tobacco and snuff, bricks, furs, some linens, vessels, and some minor articles. The chief articles of import are sugar, coffee, salt, fish, hides, cotton-twist, cotton in wool, woollen stuffs, linens, cottons, wine and brandy, wool, dye-stuffs, raisins, almonds, pepper, cinnamon, arrack and rum, butter, bacon, tobacco, soap, train-oil, oil, ginger, lacquered ware, tea, tallow, potashes, and oil.

Table III., exhibiting the amount of Shipping employed in the commercial intercourse of Sweden with different Countries in 1831.

Names of the Countries.	Tonnage of vessels bound inward.			Tonnage of vessels bound outward.		
	Swedish vessels.	Foreign vessels.	Total.	Swedish vessels.	Foreign vessels.	Total.
Norway . .	11,632	37,006	48,738	25,766	18,783	44,549
Russia . . .	14,418	51,827	66,245	28,430	54,739	83,169
Prussia . .	11,174	3,779	14,953	11,895	3,759	18,654
German States, exclusive of Hamburg and Lubeck . .	9,925	1,437	11,362	11,322	1,379	12,601
Denmark . .	46,469	5,836	52,305	66,855	4,352	71,207
Hamburg and Lubeck . .	15,117	9,081	24,198	22,678	680	23,358
Netherlands . .	2,645	5,686	8,331	8,068	3,628	11,696
Great Britain .	10,159	42,288	52,447	22,590	52,452	75,042
France . . .	7,084	1,889	8,977	30,674	4,668	35,342
Spain . . .	12,775	..	12,775	28,430	273	28,703
Portugal . .	11,313	381	11,694	6,842	..	6,842
Gibraltar . .	..	..	..	5,201	..	5,201
Sardinian States .	..	..	..	3,125	..	3,125
Tuscany . .	..	..	..	6,812	..	6,812
Naples and Sicily .	6,382	..	6,382	8,588	..	8,588
Austria . .	..	..	..	1,490	..	1,490
Algiers . . .	..	..	..	593	..	593
Egypt . . .	..	..	..	3,920	..	3,920
United States of America . .	1,246	4,905	6,151	5,379	22,545	27,924
Brazil . . .	5,477	530	6,007	8,870	..	8,870
	164,820	161,745	333,565	310,418	167,258	477,676

Education.—Sweden has two universities, Upsala and Lund. The number of students who were matriculated in 1830 amounted to 2085, of which number however only 1265 were attending the lectures. The number of grammar-schools, of which some are called gymnasia, and others trivial schools, is considerable: they were attended in 1830 by 6481 boys. Besides these there are in most of the larger towns middling schools. The number of boys who attended these schools amounted in 1830 to 3083. There are regular elementary schools only in the towns, and not in all of them: in 1830 there were only sixty-six schools of that description, in which 282 teachers were employed in teaching 4340 boys. In some parts of the country there are parish schools, and some larger villages have their own schools; but the country children are generally instructed by ambulatory teachers. For that purpose every parish is divided into school districts, each of which is visited at a certain season of the year by one or more teachers, who remain there from six to twelve weeks. This arrangement is made necessary by the population being so much scattered: the children would be obliged to walk a great distance if schools were established at fixed places. This system of instruction might be supposed to be defective; but it is stated by authority, on which every reliance can be placed, that the proportion of persons who cannot read to those who can is as 1 to 1000. It is however a general practice in Sweden for parents, especially those who live in the country, to instruct their children in the long winter evenings.

(Von Buch's *Travels through Norway, Lapland, and Sweden;* Thomson's *Travels in Sweden;* Everest, *Travels through Norway, Lapland, and part of Sweden;* Schubert's *Reise durch Schweden, Norwegen, Lapland, &c.;* Forsell's *Sta-*

tistik von Schweden; Forsell's *Anteckningar öfver Sverige*, Stockh., 1839.)

History.—The early history of Sweden, as of the other Scandinavian nations, is known chiefly from the Sagas, or chronicles, which present little more than a confused mass of fables and heroic legends. The first ascertained dynasty of kings is that of the Ynglings (so called from the third of their number, Freyer-Yngve, a grandson of Odin), who reigned from the arrival of Odin in the north, an event variously fixed at from B.C. 50 to A.D. 250, till about A.D. 630, when the last of these princes, Olaf Trætelia, was expelled by Ivar Vidfadme, a Danish king of the race of the Skioldungs, another branch of the progeny of Odin. The thrones of Sweden and Denmark continued for some time united under the descendants of Ivar Vidfadme, till at the death (794) of the famous pirate-king Ragnar Lodbrok, who fell in an expedition against the English coasts, Sweden again became a separate kingdom under his second son Biorn Ironside. Under Biorn II., grandson of Biorn Ironside, Christianity was first introduced in Scandinavia: but the mass of the people still adhered to paganism; and Erik, who reigned 993-1001, perished in a popular revolt provoked by his demolition of the heathen temples. His son Olaf however (1001-26), surnamed Skot-Konung, or the Tribute-King, from a tax which he paid to the pope, formally established the Christian faith; and the conversion of the nation was completed by his son Emund-Jacob (1026-51), for whom the severity of his legislative enactments procured the surname of Kolbrenner (the Coalburner). His successor, Emund Slemme (1051-6), fell in battle against the Goths of Gothland, then a separate nation from the Swedes; and the male descendants of Biorn Ironside being extinct, a fresh dynasty was founded (1056) by Stenkill, under whom the Swedes and Goths were for the first time united. The princes of his line, four of whom ruled from 1066 to 1129, were chiefly remarkable for their pacific virtues, and their zeal for extirpating the relics of paganism. On the death of the last, Inge II., the Swedes conferred the royal dignity on a private individual named Sverker (1129-50); while to obviate the discontent of the Goths, who supported the claims of Erik (afterwards canonized), a descendant by females of the house of Stenkill, it was agreed that Erik should succeed Sverker, and that the representatives of the two families should in future reign alternately. The reign of St. Erik (1155-61) was signalized by the final conquest and conversion of the Fins (1154), and by the compilation of an excellent code of laws: but after his death, the strange arrangements above mentioned gave rise, as might have been foreseen, to endless dissensions and civil wars. The alternate succession was however adhered to through the reigns of Charles (1161-7), son of Sverker I.; Knut or Canute, son of St. Erik (1167-99); Sverker II., son of Charles (1199-1210); Erik, son of Knut (1210-16); John Sverkerson (1216-22); and Erik Erikson (1222-50), surnamed Læspe, or the Stammerer, with whom expired the male line of St. Erik, as that of Sverker had done with John.

Waldemar (1250-76), of the Folkungar family, and a nephew of Erik Læspe by the sister's side, was raised to the vacant throne by election of the states, the government being confided during his minority (till 1266) to his father, Birger Jarl, who founded Stockholm (1254), removing the capital thither from Upsala, and first legalized hereditary nobility and inheritance by females. Waldemar was dethroned by his brother Magnus Ladulæs (1276-90), a wise and politic monarch; but the reign of his son Birger (1290-1319) was again a scene of fraternal discord, ending in his deposition in favour of his infant nephew Magnus Smek (1319-63), who also succeeded in right of his mother to the crown of Norway. The long reign of this weak and perfidious prince was a series of domestic treasons, and disastrous civil and foreign wars: he was deposed by the Diet in 1343, and his son Erik XII. substituted; and though restored on the death of Erik in 1359, he was soon finally displaced by his sister's son, Albert of Mecklenburg (1363-89). But the rule of Albert was as unpopular as that of his predecessor; and he was overthrown and made prisoner (1389) by Margaret, surnamed the Semiramis of the North, Queen of Norway and Denmark.

This remarkable princess was daughter of Waldemar Atterdag, the last male of the antient Danish kings, and widow of Hakon, king of Norway, a son of Magnus Smek. On the death of her son Olaf (1387), she had been declared queen-regnant of these two kingdoms; and having by the fall of Albert become mistress of Sweden, she formed the three northern realms into a confederate monarchy by the famous Union of Calmar (1397), the three crowns being declared indissolubly united, though the internal administration of each kingdom continued independent and separate. Margaret was succeeded by her grand-nephew Erik of Pomerania (1413-39), but his tyranny irritated the Swedes, who from the first had borne with impatience a foreign yoke: the Swedish Tell, Engelbrekhtson, expelled the Danes in 1433, and Charles Knutson Bonde was elected Riksforestandare, or administrator of the kingdom. On the death of Christopher of Bavaria, the successor of Erik, he usurped the royal title as Charles VIII. (1448-70); but though he was unable to maintain himself as king, the office of administrator was revived in his nephew Sten or Stephen Sture (1471-1505), under whom the university of Upsala was founded (1476), and printing introduced (1483). The rule of this chief and of his successors, Svante Nilsson Sture (1505-12), and Sten Sture II. (1512-20), is marked by the incessant efforts of the Danish kings to render their nominal supremacy over Sweden effectual, either by policy or arms; till Christian II., aided by the powerful family of Trolle, which was at feud with that of Sture, defeated and slew Sten Sture II. at Bogesund, and massacred at Stockholm (October 8, 1520) ninety-four prelates, senators, and nobles of the opposite party. The Swedes now flew to arms under Gustavus Erikson Vasa, the son of one of the victims; and the expulsion of the Danes (Christian being opportunely dethroned at the same time in Denmark) was followed by the unanimous proclamation of Gustavus, as king of the Swedes and Goths. Thus ended the Union of Calmar.

With the establishment of the dynasty of Vasa, the history of Sweden, as an independent and respectable kingdom, may properly be said to commence; and the new æra was further marked by a change of religion. The Lutheran doctrines had been introduced in 1522 by Olaus Petri, a disciple of the great reformer, and so rapid was their progress, that in 1528 the Confession of Augsburg was solemnly adopted as the standard of faith by the king and people at the diet of Westeras, at which the peasants first appeared as a fourth and separate estate. By the 'Act of Hereditary Union' (1540) the crown was settled on the male heirs of the king; and the treaty of Fontainebleau (1542), by which Denmark and Sweden allied themselves with France against Charles V., affords the first instance of a diplomatic correspondence between the Scandinavian states and the kingdoms of Southern Europe: but peace was concluded with the empire in 1544; and the only other wars in which Gustavus engaged were two short and indecisive ones (1536 and 1555) with Russia. The conclusion of commercial treaties with England and the Netherlands (1550) gave a new impulse to trade and navigation; and foreign artizans and men of science were invited and encouraged to settle in the country, which under this wise policy attained a degree of affluence and prosperity hitherto unknown, and was raised from the condition of a semi-barbarous and dependent territory to the rank of a considerable state. But Erik XIV. (1560-8), son and successor of the great Gustavus, was a gloomy and cruel tyrant; and after entering into rash and unsuccessful wars with Poland and Russia (1562) for Esthonia, and with Denmark (1563) on the question of national supremacy, became insane from remorse for the slaughter of the Sture family and their adherents (1567), and was deposed by the states in favour of his brother John III. (1568-92), who confined Erik in a dungeon, and at length (1577) put him to death. The rule of John was at first prosperous; the dispute with Denmark was amicably adjusted (1570) by the peace of Stettin; and the peace of Zapolia with Russia (1583) gave Ingria and Carelia to Sweden. But the attempts which he made, at the instigation of his wife, a Polish princess, to restore a modified form of Catholicism, gave rise to religious disputes which occupied great part of his reign; and Charles, duke of Sudermania, the king's brother, headed the Lutheran party, which regained the ascendant on the queen's death, though Catholicism was still tolerated. John was succeeded by his son Sigismund (1592-1604), who had, in 1587, been elected king of Poland in right of his mother: but his open profession and patronage of Catholicism speedily alienated the Swedes, and a civil war commenced, which continued at intervals till 1604, the king being supported by Polish troops: till at length the diet of Norrköping formally pro-

hibited the obnoxious faith, and raised the duke of Sudermania to the throne as Charles IX. (1604-11) in the place of his nephew. From this revolution arose the Swedo-Polish war of succession, which continued almost without intermission for 60 years (1600-60). At first the Poles were successful, overrunning Livonia, &c., and defeating the Swedes at Kerkholm (1507): but the attention of both was drawn off by the distracted state of Russia, which had become a prey to anarchy and civil war since the extinction of the line of Rurik in 1598. Sweden at first espoused the cause of the czar Schuiski, and sent a force to his aid under the famous General de la Gardie: but on the fall of their ally the Swedes occupied Kexholm and Novgorod, and even attempted to raise Charles Philip, second son of the Swedish king, to the throne of Russia. A short but bloody war with Denmark (1611-13), usually called the war of Calmar, on the subject of the northern limits of Lapland and Norway, was ended to the disadvantage of Sweden by the peace of Siorod: but in the meantime Charles IX. had been succeeded by his son, the famous Gustavus Adolphus (1611-32). The first acts of his reign were directed to legislative improvements and the extension of commerce and agriculture, in which he was aided by his illustrious minister Oxenstierna: while the privileges of the nobles, which his father had curtailed, were restored and even extended. By the peace of Stolbova (1617), concluded under the mediation of England, Russia ceded all her remaining territory on the Baltic; and the king, heading his army against the Poles, took Riga (1621), and subdued Livonia and Polish Prussia, which were ceded to Sweden (1629) by the truce of Altmark. His arms were now turned towards Germany, where the success of Austria in the Thirty Years' War seemed to threaten Protestantism with annihilation; and being chosen captain-general of the Protestant league, he landed in Pomerania, June, 1630: but the campaigns and victories of the Lion of the North, till his fall in the moment of triumph at Lützen (November 6, 1632), belong to German rather than Swedish history.

Christina (1632-54), the daughter of Gustavus Adolphus, succeeded at the age of six years, under the guardianship of Oxenstiern, who administered the kingdom with consummate ability; while the generals Wrangel, Torstensohn, Bannier, and Bernhard of Saxe Weimar, carried the renown of the Swedish arms to the highest pitch in Germany. A short war with Denmark (1643-45), in which Sweden was the aggressor, was terminated to the advantage of the latter by the peace of Bromsebro; and at the general peace of Westphalia (1648), Sweden received Pomerania, Rugen, Bremen, &c., with the annexed rights as a state of the empire: acquisitions which elevated her to the rank of a first-rate power. But the eccentric tastes of Christina, who was devoted to abstruse literature, indisposed her for the cares of government; and in 1654 she abdicated the crown in favour of her cousin, the Count Palatine of Deux-Ponts, she retired to France, and afterwards to Rome, where she died a Roman Catholic in 1689. The new king, Charles Gustavus (1654-60), renewed the war with Poland, which he completely overran, taking Warsaw, Cracow, &c.: then attacking Denmark, which had espoused the cause of Poland, he crossed the Belts on the ice, menaced Copenhagen, and compelled the cession (by the peace of Roskilde, 1658) of Scania and all the other Danish provinces beyond the Sound. A fresh attempt to subdue Denmark completely was frustrated by the succour of the Prussians and Dutch, who repulsed the Swedes from before Copenhagen; and the disappointed ambition of the king is said to have hastened his death. During the minority of his son Charles XI. (1660-97), the long contest with Poland was concluded (1660) by the peace of Oliva; Livonia, Esthonia, and Oesel were confirmed to Sweden, and the claim of the Polish kings to the Swedish crown was given up. The rise of the French and anti-French parties at court produced several changes of policy; but the predominance of the former at length gave rise to a war with Prussia and Denmark (1675-79), in which the Swedes were generally worsted, but at the peace of Fontainebleau (1679) regained all that they had lost. This reign was also the epoch of the first struggle between the crown, supported by the burghers and peasants, and the power of the senate and nobles: the resumption of the crown lands (1680), and the liquidation of the public debt by raising the value of the currency (1686), were the preliminary measures; and in 1693 the king was formally declared absolute by an act of the Diet. He died in 1697, leaving his dominions to his son, the famous Charles XII. (1697-1718), then only fifteen, in the highest state of prosperity and organization; but the inexperience of the young king tempted the attacks of his neighbours, and a coalition was formed against him (1699) by Poland, Denmark, and Russia. Charles assumed the offensive, and leading his forces first against Denmark, in six weeks reduced the king to sue for peace (peace of Travendahl, 1700): he next utterly routed the Czar before Narva; then invading Poland (victory of Riga, 1701—capture of Warsaw and Cracow, and victory of Clissau, 1702—victory of Pultusk, 1703), he in two years expelled the king, Frederic Augustus, elector of Saxony, and dictated the election of Stanislaus Leczinki (1704) in his room; while Frederic Augustus, attacked in his electoral dominions, was compelled to cede his rights by the treaty of Alt-Ranstadt (1706). Europe viewed with amazement the career of the Swedish hero: but his invasion of Russia (1708-9) was fatal to his schemes of ambition. Having turned aside into the Ukraine to form a junction with the Cossack chief Mazeppa, he was overthrown at Pultowa (July, 1709), and took refuge for five years in Turkey: while the league against him was joined by Denmark, Prussia, and England; and all his conquests, in spite of the efforts of his generals, were lost as rapidly as they had been gained. In 1715 he returned to Sweden; but while he was endeavouring to re-establish his power both by arms and by the subtle diplomacy of his minister Görtz, he fell at the siege of Fredericshall in Norway, leaving his kingdom on the verge of ruin. His sister Ulrica-Eleonora (1718-20), though proclaimed by the senate as elected queen, was compelled to renounce all hereditary right, and restore the constitution as before 1693; but after concluding the peace of Stockholm (1720) with England, Denmark, Prussia, and Poland, she resigned the crown in favour of her husband Frederic of Hesse-Cassel (1720-51), whose authority was still further limited by the Act of Royal Assurance, exacted from him by the states. The treaty of Nystad with Russia (1721) at length gave peace to the exhausted kingdom; but Ingria, Livonia, Esthonia, Carelia, Oesel, &c., were ceded to the Czar, and Sweden sunk thenceforth into a second-rate power.

For the next twenty years the court of Stockholm was a scene of foreign intrigue and corruption, in which the Hats, or French party, and the Caps, or Russian faction, alternately predominated, the royal prerogative being almost annihilated by the power of the aristocracy: but agriculture and commerce nevertheless flourished, while Linnæus and his disciples gave a new impulse to science, and legislation was improved by the publication of a new code (1734). The ascendancy of the Hats led to a war (1741) with Russia, which was vainly opposed by the king; but the Swedes were everywhere defeated, and the peace of Abo (1743) was obtained, through British mediation, by the cession of part of Finland, and the recognition of duke Adolphus Frederic of Holstein-Gottorp as heir to the throne, the king being childless.

The orders of the Sword, Seraphim, and Polar Star were instituted or revived during this reign.

The reign of Adolphus Frederic (1751-71) was peaceful in its foreign relations, with the exception of the share taken against Prussia, through the influence of the Hats, in the Seven Years' War, concluded by the peace of Hamburg (1762) without territorial changes: but the struggles of the Hats and Caps kept the nation in a constant ferment, and the thraldom of the king by the nobles was carried to such an extent as to produce a threat of abdication (1768). The counter-revolution did not take place however till the reign of his son Gustavus III. (1771-92), who, in 1772, supported by the army and the body of the people, forcibly repealed the constitution of 1720, re-establishing the relative powers of the various branches of government nearly as before 1680: while the party-names of Hats and Caps were for ever prohibited, the use of torture abolished, and the press declared free. These changes were distasteful to Russia, to whose policy the consequent increase of national energy was unfavourable, and whose partizans, the Caps, had been dominant immediately before: but no rupture followed at the time; and in 1780 Sweden joined the Armed Neutrality of the northern powers against England, headed by the Czarina: while a commercial treaty was concluded (1783) with the United States of America. But an alliance with the Porte (1787) led to a war the next year with Russia, and

with Denmark as her ally: but the mutinous conduct of the Swedish officers, who refused to invade Russia without orders from the States, produced the Act of Safety (1789), which was forced on the nobles by the other orders of the Diet, and which gave the king absolute power of war and peace, at the same time abolishing the senate, the last stronghold of aristocratic power. In the sea-fight of Viborg (July 3, 1790) the Swedes were defeated; but they gained a decisive victory (July 10) at Svenkasund, taking or destroying 42 ships and 8000 men: and the peace of Werela (1790) was concluded on the basis of mutual restoration. The outbreak of the French revolution induced an alliance (1792) with Russia and Austria, and a plan was concerted for a combined invasion of France under the command of Gustavus: but the king was assassinated the same year (March 16) by Ankarström, an agent of the discontented nobles; and his brother, the duke of Sudermania, who was regent till 1796 for his nephew Gustavus IV. (1792-1809), not only withdrew from the coalition, but recognised the French republic in 1795. The search of neutral vessels by the English, and some acts of hostility thence arising, provoked the formation of the Armed Convention of the North (1800) between Russia, Denmark, Sweden, and Prussia; but it was dissolved the next year at the death of the emperor Paul. In 1805, an alliance was formed with Russia and England against Napoleon, whom Gustavus had refused to acknowledge as emperor; but the French occupied Pomerania and Stralsund (1807); and Russia, after the conferences of Tilsit, turned her arms against her late ally, and seized upon Finland, the impregnable fortress of Sveaborg being betrayed by the governor. An auxiliary force of 11,000 English, under Sir John Moore, was dismissed without effecting anything: the Danes also declared war; and Tornea and the Aland Isles were taken by the Russians (1809). These multiplied misfortunes were ascribed to the incapacity of the king, who was considered to have shown symptoms of mental derangement: and he was deposed (March, 1809) by a conspiracy of military officers, his uncle Charles XIII. (1809-18) being called to the throne to the exclusion of the son of Gustavus, who was declared incapable of ever inheriting. A few aristocratic modifications were introduced in the constitution, as the appointment of a state-council of nine members, &c.; but the general outline was left as settled in 1772. The peace of Fredrickshamn with Russia (1809) was dearly purchased by the cession of Finland, East Bothnia, and Aland (or nearly one-fourth of the territory, with one-third of the population, of the kingdom): but France restored Pomerania (1810) on the adoption of the continental system prescribed by Napoleon. The sudden death (1810) of the prince of Holstein-Augustenburg (who had been declared heir to the throne), and the age and childlessness of the king, necessitated a fresh election of a crown-prince; and the choice of the states fell on Bernadotte, prince of Ponte-Corvo, the ablest of the marshals of Napoleon, whom this selection was probably intended to propitiate. Bernadotte assumed, on his arrival, the reins of government; but though compelled by France to declare war against England, he too clearly perceived the true interests of Sweden to enter on active hostilities; and, on the reverses of Napoleon in Russia, peace and alliance was concluded with England at Orebro, and with Russia at Abo. During the War of Liberation (1813) in Germany, the Swedish troops were led by the crown-prince, to whose counsels the plan of the campaign has been usually attributed; and their services were rewarded (1814) by the acquisition of Norway, which Denmark was compelled to cede by the peace of Kiel, Sweden at the same time resigning to Prussia Pomerania and her remaining German possessions. After some fruitless resistance on the part of the Norwegians, this arrangement was carried into effect by the convention of Moss (August 14), the two crowns being declared indissolubly united, though each kingdom retained its separate constitution. On the death of the king in 1818, the crown-prince mounted the throne as Charles XIV., and was crowned at Stockholm and Trondheim; and his rule, from that period to the present, has been marked by the uniform and increasing prosperity of the Scandinavian kingdoms. A quarter of a century of peace, and the unceasing attention paid by the king to the cultivation and improvement of the internal resources of his dominions, have in a great measure remedied the accumulation of evils resulting from a long period of misgovernment, domestic broils, and disastrous foreign wars. Notwithstanding the loss of Finland, the commerce of Sweden is now more than double what it was in 1800, and the opening of the Gotha canal (1832) has greatly added to the facilities for internal water-communication. It has been said that a party in the state will attempt, on the demise of the king, to supplant his son Oscar in the succession, and restore the son of Gustavus IV., now a general in the Austrian service: but it is improbable that such an enterprise would be successful; and whatever may be the stability of the present dynasty, the memory of Charles XIV. will be deservedly held in reverence by his subjects in both kingdoms.

The Swedish constitution, after its repeated fluctuations between absolute monarchy and aristocratic predominance, may be considered as having settled, since the last modifications in 1809, into a tolerably fair equilibrium. The crown is declared hereditary in the male line, and the king is required to profess the Lutheran religion, which is the established creed of the realm. The state-council consists of nine members, who are the privileged advisers of the king, and who must also be Lutherans, and Swedes by birth: six of the number are appointed by the king, but three of these must be civil functionaries: the chancellor and the ministers of justice and foreign affairs are *ex-officio* members; and the four secretaries of state may be summoned to give advice on matters relating to their own departments. The foreign relations (both as to peace and war, and commercial and other treaties), the supreme administration of justice, and the command of the army and navy, are vested in the king; who has also the appointment of the archbishops and bishops, and the judges: but these are removable only for misconduct. He has also a negative voice on the resolutions of the diet, and the right to introduce measures for their consideration: but he can neither control the freedom of their deliberations, nor (without their sanction) impose new taxes, contract loans, or alienate any part of the territory. The diet, or parliament of the kingdom, in which resides the supreme legislative power, consists, as of old, of the four orders of nobles, clergy, burghers, and peasants (landholders who are not noble): the number of members varies considerably. In the house of nobles, the head of each of the 2300 noble families has a seat by right, but seldom more than 400 to 500 attend. The ecclesiastic order (of which the archbishop of Upsala is always president) consists, besides the twelve bishops, of about sixty deputies from the various dioceses. The presidents of the burgher and peasant houses are named by the king, and a small property qualification is required for a deputy: the proper number of burgher representatives is 97, of whom Stockholm returns 10, Gottenborg 3, Norrköping 2, and 82 other cities and towns each 1: the peasant deputies should be 144, returned by different districts; but the full number rarely if ever make their appearance. The expenses of the representatives of the three last classes are partly reimbursed by their constituents; and the civil and military employés of government, far from being ineligible, usually form a large majority of the whole number. The four orders sit and deliberate sometimes separately, and at other times altogether; and the question is carried or lost by a simple majority, unless it involves a fundamental change in the laws or constitution. In this case the motion cannot be debated in the same meeting in which it is propounded, but is adjourned to the next session, when it is discussed by a general congress of the four orders, and can only be passed by a unanimous vote. The Diet meets at Stockholm every fifth year, and the session should close at the end of three months, unless prevented by a press of business.

SWEDENBORG, EMANUEL (the second child and eldest son of Jesper Swedberg, bishop of Skara in Westrogothia, and of Sarah Behm, daughter of Albert Behm, assessor of the board of mines), was born at Stockholm on the 29th of January, 1688. [SWEDBERG.] Of his childhood and youth there is no record, excepting that his mind was early occupied by religious subjects. 'From my fourth to my tenth year,' says he, in a letter to Dr. Beyer, 'my thoughts were constantly engrossed by reflecting on God, salvation, and the spiritual affections of man. From my sixth to my twelfth year, it was my greatest delight to converse with the clergy concerning faith, and I often observed to them that charity or love is the life of faith, and that this vivifying charity is no other than the love of one's neighbour.'

Bishop Swedberg bestowed great care on the education of his son, which he received principally at the University of Upsala. He was uncommonly assiduous in the study

of the learned languages, mathematics, and natural philosophy. At the age of twenty-two he took his degree of doctor of philosophy, and published his first essay,—the academical dissertation which he had written for the degree. This essay is entitled 'L. Annæi Senecæ et Pub. Syri Mimi, forsan et aliorum selectæ sententiæ, cum annotationibus Erasmi et Græca Versione Jos. Scaligeri. Quas cum consensu Ampl. Fac. Philos. notis illustratas sub præsidio Viri amplissimi Mag. Fabiani Törner, Philos. Theoret. Prof. Reg. et ord. publico examini modeste submittit Emanuel Swedberg in audit. Gustav. maj. d. 1. Jun, 1709, Upsaliæ.'*

In 1710 Swedberg came to London, just at the time the plague was raging in Sweden, when all Swedish vessels were commanded by proclamation to keep strict quarantine. He was persuaded to land (probably in ignorance of the regulation); and he has recorded, in his Itinerarium of these travels, that he narrowly escaped being hanged for the offence. He spent some time at Oxford, and lived afterwards for three years abroad, chiefly in Utrecht, Paris, and Greifswalde, returning to Sweden in 1714, through Stralsund, just as Charles XII. was commencing the siege of that city. His next productions were, a small volume of fables and allegories in Latin prose ('Camœna Borea, cum heroum et heroidum factis ludens, sive Fabellæ Ovidianis similes, sub variis nominibus scriptæ, ab E. S., Sueco, Liber i. Gryphiswaldiæ,' 1715) ('Act. Liter. Sueciæ,' vol. i., p. 589), and a collection of Latin poems ('Ludus Heliconius, seu Carmina Miscellanea, quæ variis in locis cecinit Eman. Swedberg, Skara').* In 1716 Swedberg commenced his 'Dædalus Hyperboreus,' a periodical record of inventions and experiments by Polhem and others, and of mathematical and physical discoveries of his own. This work was published at Upsal in Swedish, in six parts (the fifth part with a Latin version); it is said to contain the lucubrations of a scientific society which was instituted by Berzelius among the professors of the university. (*Nov. Act. Reg. Soc. Scient.*, Upsal., vol. v., 1792.) In the course of 1716 Swedberg was invited by Polhem, the great Swedish engineer, to repair with him to Lund to meet Charles XII., on which occasion he was admitted to much intercourse with the king, who, without solicitation on Swedberg's part, and while he was yet at the university, appointed him assessor in the Royal Metallic College of Sweden. The diploma conferring the appointment, dated at Lund, the 18th of October, also stated 'that the king had a particular regard to the knowledge possessed by Swedberg in the science of mechanics, and that the royal pleasure was that he should accompany and assist Polhem in constructing his mechanical works.' These works were to consist of the formation of the basin of Carlscrona, and of locks between Lake Wener and Gottenburg, among the rapids and cataracts at Trollhätta. (*Hist. de Ch. XII. de Nordberg*, tom. iv., app. n. cccxi.) The king also had the design of uniting his engineers by closer ties, for he recommended Polhem to give his daughter in marriage to Swedberg: the match was however prevented by the lady, who had a more favoured suitor.

The 'Dædalus Hyperboreus' was completed in 1718, in which year 'Swedberg executed a work of the greatest importance during the memorable siege of Frederickshall, by transporting over mountains and valleys, on rolling machines of his own invention, two galleys, five large boats, and a sloop, from Stromstadt to Iderfjol, a distance of fourteen miles. Under cover of these vessels the king brought his heavy artillery, which it would have been impossible to have conveyed by land, under the very walls of Frederickshall.' (Sandel's *Eulog.*) Swedberg's next literary works were, 1. 'The Art of the Rules' (an Introduction to Algebra, of which a full analysis may be seen in the 'Acta Literaria Sueciæ,' vol. i., p. 126 to 131); only a part of this work was published: the manuscript portion, according to Lagerbring, contains the first account given in Sweden of the Differential and Integral Calculus; 2. 'Attempts to find the Longitude of places by means of the Moon.' (*A. L. S.*, vol. i., pp. 27 and 315.) These treatises were both in Swedish, and were both published at Upsal in 1718.

In 1719 he was ennobled by Queen Ulrica Eleonora under the name of Swedenborg. From this time he took his seat with the nobles of the Equestrian order in the triennial assemblies of the states. His new rank conferred no title beyond the change of name, and he was not, as is commonly supposed, either a count or a baron: he is always spoken of, in his own country, as 'the assessor Swedenborg.' In this year he published three works in Swedish: 1. 'A Proposal for a Decimal Arrangement of Coinage and Measures, to facilitate Calculation and suppress Fractions' (Stockholm); 2. 'A Treatise on the Motion and Position of the Earth and Planets' (Skara); 3. 'Proofs derived from appearances in Sweden, of the depth of the Sea, and the greater Force of the Tides in the earliest ages' (Stockholm). Occasional papers by him appeared in the 'Acta Lit. Suec.' for 1720-21. Two of these have been translated into English. (See *Acta Germanica*, pp. 66 to 68, and pp. 122 to 124, vol. i., London, 1742.)

In the spring of 1721 he again went abroad through Denmark to Holland, and published the six following small works at Amsterdam: 1. 'A Specimen of Principles of Natural Philosophy, consisting of New Attempts to Explain the Phenomena of Chemistry and Physics by Geometry' (Prodromus Principiorum Rerum Naturalium, sive novorum tentaminum Chemiam et Physicam experimentalem Geometrice explicandi): 2. 'New Observations and Discoveries respecting Iron and Fire, with a new mode of constructing Stoves' (Nova Observata et Inventa circa ferrum et ignem: una cum nova camini inventione); 3. 'A new method of finding the Longitude of Places, on Land or at Sea, by Lunar Observations' (Methodus nova inveniendi Longitudines Locorum, Terra Marique, Ope Lunæ); 4. 'A mode of constructing Docks' (Modus construendi Receptacula Navalia); 5. 'A new way of making Dykes' (Nova Constructio Aggeris Aquatici); 6. 'A mechanical method for Testing the Powers of Vessels' (Modus Mechanice explorandi Virtutes Navigiorum). From Amsterdam he went to Aix-la-Chapelle, Liége, and Cologne, and visited the mines and smelting-works near those places. He arrived at Leipzig in 1722, and there published, in three parts, 'Miscellaneous Observations on Natural Objects, particularly Minerals, Fire, and Mountain-strata' (Miscellanea Observata circa Res Naturales, præsertim mineralia, ignem et montium strata). At Hamburg, during the same year, he published a fourth part, 'On Minerals, Iron, and the Stalactites in Baumann's Cavern' (Precipue circa mineralia, ferrum, et stalactitas in Cavernis Baumannianis). (*Act. Erudītor. Lipsiens.*, 1723, p. 96-7.) This work, like those which precede it, shows a rare power both of accumulating facts and applying principles. We learn from it that Swedenborg, among his other employments, was officially appointed to visit, and to propose for selection the parts of the Swedish coast which were best fitted for the preparation of salt; on which subject the 'Miscellaneous Observations' contains an admirable business-like memoir. The fourth part gives the substance of several conversations between Charles XII. and Swedenborg, in which the king proposed a new 'sexagenarian calculus.' Swedenborg made the last-mentioned tour principally to gain a practical knowledge of mining. At Blankenburg he experienced great kindness from Louis Rudolph, duke of Brunswick, who defrayed the whole expense of his journey, and at his departure presented him with a golden medallion and a weighty silver goblet. After being abroad a year and three months, he returned home, and in the course of 1722 he published anonymously, at Stockholm, a work entitled 'Om Swenska Myntets Förnedring och Förhojning' ('On the Depreciation and Rise of the Swedish Currency') (*Cat. Bibl. Upsal*, Upsal, 1814): and at the end of the same year he entered, for the first time, on the actual duties of the assessorship, the functions of which he had been unwilling to exercise before he had perfected his knowledge of metallurgy. For the next ten years he divided his time between the business of the Royal Board of Mines and his studies. In 1724 he was invited by the consistory of the university of Upsala to accept the professorship of pure mathematics, vacant by the death of Nils Celsius, because 'his acceptance of the chair would be for the advantage of the students, and the ornament of the university;' but he declined the honour. In 1729 he was admitted a member of the Royal Academy of Sciences at Upsala. In 1733 he again travelled into Germany. It seems from his posthumous 'Itinerarium' (edited by Tafel, Tübingen, 1840) that he visited Berlin, Dresden, Prague, and Carlsbad, and, arriving at Leipzig at the end of the year, put to press a great work he had just completed. During the printing of this work he spent twelve months in visiting the Austrian and Hungarian mines.

Swedenborg's 'Opera Philosophica et Mineralia' were

* The dissertation and the poems were edited and reprinted last year, 1841, by Dr. J. F. I. Tafel, at Tübingen, Wirtemberg.

published in 1734, in 3 vols. folio, at Dresden and Leipzig; his patron, the Duke of Brunswick, at whose court he was a visitor, defrayed the cost of the publication. This large work consists of three distinct treatises. The 1st volume is 'Principles of Natural Philosophy, consisting of new attempts to explain the phenomena of the elemental world in a philosophical manner' (Principia Rerum Naturalium, sive Novorum Tentaminum Phænomena Mundi Elementaris Philosophice explicandi). It is dedicated to the Duke of Brunswick, and has an engraved likeness of the author, but of very inferior execution. The 'Principia' is an attempt to construct a cosmology *à priori*. The second and third volumes are together called the 'Regnum Minerale;' the second is on iron, the third on copper and brass. They treat of the methods employed in all parts of Europe, and in America, in preparing and working these metals. Part of the second volume has been translated into French, and inserted in the 'Description des Arts et Metiers.' Each volume is subdivided into three parts, and illustrated by numerous copper engravings. (For an opinion on the practical merits of this work, see Mortimer's *Translation of Cramer's Elements of the Art of Assaying Metals*, p. 13, 2nd edition, London, 1764.) In the same year, and at the same places, Swedenborg published 'An Introduction to the Philosophy of the Infinite, and the Final Cause of Creation; treating also of the Mechanism of the Operation between the Soul and the Body' ('Prodromus Philosophiæ Ratiocinantis de Infinito, et Causa Finali Creationis; deque Mechanismo Operationis Animæ et Corporis'). This work connects his cosmology with his physiology.

Swedenborg's reputation was now established throughout Europe, and Christ. Wolff and other foreign literati eagerly sought his correspondence. On the 17th December, 1734, the Academy of Sciences of St. Petersburg appointed him a corresponding member. In 1736 he again travelled, and in 1738 visited Italy, and spent a year at Venice and Rome. The journal of his tour, from 1736 to 1739, is in MS. in the Academy at Stockholm. At this time he no doubt applied himself particularly to anatomy and physiology, of a masterly acquaintance with which he gave evidence in his 'Economy of the Animal Kingdom' ('Œconomia Regni Animalis'), a large work in two parts, 4to., which he published at Amsterdam in 1740-41. The first part treats of the blood, the arteries, the veins, and the heart, concluding with an introduction to rational psychology. The second part treats of the coincidence between the motions of the brain and the lungs, of the cortical substance of the brain, and of the human soul. In 1741 he became a fellow, by invitation, of the Royal Academy of Sciences of Stockholm, the Memoirs of which he enriched with a paper on inlaying. (*Kongl. Swenska Wetens. Acad. Handlingar*, vol. xxiv., p. 107-113.) He still continued earnest in the pursuit of physiology, and in 1744 published the 'Animal Kingdom' ('Regnum Animale') parts i. and ii., 4to., at the Hague, and in 1745, part iii., in London. The first part of this work is an analysis of the abdominal viscera; the second, of the thoracic viscera; the last part treats of the skin, of the senses of taste and touch, and of organised forms in general. The plan of both the foregoing works is peculiar to Swedenborg. Although he cultivated anatomy practically, he considered that the standard authorities of his time were more to be relied on than his own dissections (*Œcon. R. An.*), on which account he premised the descriptive statements of Heister, Winslow, Malpighi, Morgagni, Boerhaave, Leeuwenhoek, Swammerdam, &c., as his basis for induction. On the facts supplied by these authorities he built his own superstructure, which, if not strictly a physiological one, in the modern meaning of the word, is at least an elevated and original system of animal geometry and mechanics. These great works were regarded by him as only the commencement of a work in which he designed to embrace the entire circle of physiology and psychology. (*Regn. Anim.*, n. 14.)

At the beginning of 1745 Swedenborg published in two parts, 4to., 'The Worship and Love of God' ('De Cultu et Amore Dei'): the first part, on the origin of the earth, on paradise, and the birth, infancy, and love of the first man; the second part, on the marriage of the first man, and on the soul, the intellectual mind, the state of integrity, and the image of God. This book is a sublimation of Swedenborg's scientific system, with a correlative statement of his psychical doctrines, in which both are blended, and clothed with the narrative form: it is the link between his physiology and a class of doctrines which was yet to come.

A number of unpublished scientific MSS., written by him previously to this period, and which are preserved in the Royal Academy of Sciences at Stockholm, manifest his industry, and the largeness of his designs. The most important of these papers appear to be—'De Magnete,' p. 273, 4to.; 'De Sale Communi,' p. 313; 'Principia Rerum Naturalium, ex priori et posteriori educta,' p. 569; 'De Sensatione,' cap. xiii.; 'De Actione,' cap. xxxv.; 'De Cerebro, Medulla Oblongata, et Spinali, de Nervis, analytice, physice, philosophice;' 'De Aure Humana;' 'Tractatus Partium Generationis utriusque Sexus, et de Processu Generationis.' (*Intellectual Repository*, January, 1836; *Rep. of London Printing Society*, 1841.)

We shall now endeavour to take a brief review of Swedenborg's scientific progress, with particular reference to method, principles, and doctrines. His proper career may be dated from the publication of the 'Prodromus Principiorum.' In this work he attempted to account for chemical combination by a theory of the forms and forces of the particles of bodies, and to resolve chemistry into natural geometry, that it might have the benefit of first principles, and the rank of a fixed science. Of these forms he gave many delineations. (Plates to *Prodr. Princip.*) He broached the ingenious doctrine that the particles of primary solids are moulded in the interstices of fluids, and take the shape of those interstices: and that particles so modelled, by undergoing fracture at their weakest points, give rise to new shapes, which become the initial particles of new substances. He anticipated Dr. Wollaston's suggestion of the spheroidal composition of crystals, as well as the atomic theory of Dalton, and even some of its details, as when, geometrically predicting the composite nature of water, he assigned to it the equivalent of 9. (*Prodromus Principiorum.*)

The rules which he proposed for investigating the constitution of the magnetic, luminous, and atmospheric elements come next under our notice. '1. That we take for granted that nature acts by the simplest means, and that the particles of elements are of the simplest and least artificial forms. 2. That the beginning of nature is the same as the beginning of Geometry: that natural particles arise from mathematical points, precisely as lines, forms, and the whole of geometry; and this, because everything in nature is geometric; and vice versâ. 3. That all the above elements are capable of simultaneous motion, in one and the same place; and that each moves naturally without hindrance from the others. 4. That ascertained facts be the substratum of theory, and that no step be taken without their guidance.' (*Miscell. Obs.*, part iii.)

From these rules we pass to their application, in the outset to which Swedenborg boldly averred that the records of science, accumulating as they had been for thousands of years, were sufficient for an examination of things on principles, and *à priori*; that a knowledge of natural philosophy does not presuppose the knowledge of innumerable phenomena, but only of principal facts which proceed directly, and not of those which result obliquely and remotely, from the world's mechanism and powers; and that the latter species of facts confuse and disturb, rather than inform the mind. Also, that the restless desire, from age to age, for more facts, is characteristic of those who are unable to reason from principles and causes, and that no abundance would ever be sufficient for such persons. (*Principia, de Mediis ad Ver. Philos.*, p. 3, 4.) The following is a statement of the doctrine of the elemental world proposed in the 'Principia:'—'1. In the simple (substance) there is an internal state and corresponding effort tending to a spiral motion. 2. In the first finite which arises from it there is a spiral motion of the parts; so also in all the other finites. 3. From this single cause there arises in every finite a progressive motion of the parts, a motion of the whole on its axis, and if there be no obstacle, a local motion also. 4. If a local motion ensues, an active arises; each active similar to the others. 5. From finites and actives arise elementaries, each so similar to the others, as to differ from them only in degree and dimension. Thus we presume the existence of only three kinds of entities—finites, actives, and their compounds, elementaries, of which the finites occupy the surface, the actives the interiors. With regard to the finites, one is generated from the other, and they are all exactly similar, excepting in degree and dimension: thus, the fifth finite is similar to the fourth, the fourth to the third, the third to the second, the second to the first, and

the first to the simple; so that when we know the nature of one finite, we know that of all. Precisely the same may be said of the actives and of the elementaries. In the effort of the simple towards spiral motion lies the single cause and the first force of all subsequent existences.' (*Principia*, p. 450-1.) Swedenborg first states these doctrines synthetically, and then educes the same from, and confirms them by, the phenomena of nature. We may here, with propriety, introduce a remark from Sandel:—'He thus formed to himself a system founded upon a certain species of mechanism, and supported by reasoning; a system, the arrangement of which is so solid, and the composition so serious, that it claims and merits all the attention of the learned; as for others, they may do better not to meddle with it.'

In approaching the human body he again insisted on the necessity for principles and generalization, without which, he said, 'facts themselves would grow obsolete and perish;' adding that, 'unless he were much mistaken, the destinies of the world were leading to this issue.' A knowledge of the soul became the professed object of his inquiry, and he 'entered the circus with a resolve to examine thoroughly the world, or microcosm, which the soul inhabits, in the assurance that she should be sought for nowhere but in her own kingdom.' In this search he repudiated synthesis, and 'resolved to approach the soul by the analytic way,' adding, 'that he believed himself to be the first investigator who had ever commenced with this intention;' a surmise in which he is probably correct. We shall here content ourselves with a brief illustration of one of those doctrines which, 'with the most intense study,' he elaborated for his guidance, we mean the 'doctrine of series and degrees.' Each organ, he observed, commences from certain unities or least parts which are peculiar to it, and derives its form from their gradual composition, and its general function from the sum of their particular functions. The mass is therefore the representative of its minute components, and its structure and functions indicate theirs. The vesicles or smallest parts peculiar to the lungs are so many least lungs; the biliary radicles of the liver, so many least livers; the cellules of the spleen, so many least spleens; the tubuli of the kidneys, so many least kidneys; and the same function is predicable of these leasts, as of their entire respective organs, but with any modification which experience may declare to be proper to the minuter structures. This new method of analysis, in which the greatest things were presumed to indicate the least, with just such reservation as our experience of the least necessitates, was designed to throw light on the intimate structure and occult offices of single organs—the same way identified the higher with the lower groups of organs—the cranial with the thoracic, and both with the abdominal viscera. Whatever is manifested in the body is transferrible to the brain, as the source of all functions and structures. If the abdominal organs supply the blood with a terrestrial nourishment, the thoracic supply it with an aërial, and the brain with an ethereal food. If the first-mentioned organs, by the urinary and intestinal passages, eliminate excrements and impurities, so the lungs by the trachea, and the brain through the sinuses, reject a subtler defilement. If the heart and blood-vessels are channels of a corporeal circulation, the brain and nerves, or spirit-vessels, are channels of a transcendent or spirituous circulation. If the contractility of the arteries and of muscular structures depends on the nervous system, it is because that system is itself eminently contractile, and impels forwards its contents in the most perfect manner. If the lungs have a respiratory rising and falling, and the heart a contraction and expansion, so the brain has an animatory movement, which embraces both the motions of the lower series. Thus every function is first to be traced to its essential form in the bosom of its own organ, and thence, through an ascending scale, to the brain, 'which is eminently muscle, and eminently gland; in a word, which is eminently the microcosm, when the body is regarded as a macrocosm.' (*Œcon. R. A.; Regn. Anim.*)

On the whole we may admit these works to be a grand consolidation of human knowledge;—an attempt to combine and re organize the opinions of all the schools of medicine since the days of Hippocrates. The doctrines of the fluidists, of the mechanical and chemical physicians, and of the vitalists and solidists, as well as the methods of the dogmatists and empirics, and even the miscellaneous novelties of the present day, have each a proportion and a place in the catholic system of Swedenborg. His works however are a dead letter to the medical profession, or known only to its erudite members through the ignorant misstatements of Haller. (Haller's *Bibliotheca Anatomica*, tom. ii., pp. 328, 329, Tiguri, 1777.)

Swedenborg was in his fifty-eighth year when he published the last of the foregoing volumes, and from this period he assumed a new character, of which he gave the following account:—'I have been called to a holy office by the Lord, who most graciously manifested himself in person to me, his servant, in the year 1745, and opened my sight into the spiritual world, endowing me with the gift of conversing with spirits and angels.' However repulsive such statements are to the generality of mankind, they are not *à priori* objectionable to those who admit the inspiration of the seers and prophets of the Bible: after such an admission of the supernatural, each particular case of the kind becomes a simple question of evidence. The event above alluded to happened to Swedenborg in the middle of April, 1745, at an inn in London. The manner of its occurrence is recorded by M. Robsahm, director of the bank of Stockholm, who was a trusted friend of Swedenborg, and had the narration from him personally. (See Robsahm's *Memoiren*, in Tafel's *Swedenborg's Leben*, pp. 8 to 10, Tübingen, 1842.) From this period, Swedenborg entirely forsook the pursuit of science, nor does he once allude, in his works on theology, to his former scientific labours. He still however took part in the proceedings of the Diet, and in that of 1761 he is stated by Count Hopken to have presented the best memorial on the subject of finance.

He returned from London to Sweden in August, 1745, and immediately devoted himself to the study of Hebrew and the diligent perusal of the scriptures. He continued to discharge the duties of assessor of the Board of Mines till 1747, when he asked and obtained his majesty's permission to retire from it; adding also two other requests, which were granted—that he might enjoy as a pension the salary of the office; and that he might be allowed to decline the higher rank which was offered him on his retirement. The materials for the subsequent part of Swedenborg's biography are exceedingly scanty. He was now either actively engaged in writing his theological works, or was travelling in foreign countries to publish them. When he was at home he had a house in the environs of Stockholm, with a large garden, in which he took great delight. He frequently resided in Amsterdam and in London. The highest personages in Sweden testified to the consistency with which he maintained the assertion of his spiritual intercourse. On one or two occasions, they say, he gave proof of his professions. Baron Grimm, after describing him as 'a man not only distinguished by his honesty, but by his knowledge and intelligence,' says of one of these occurrences, 'This fact is confirmed by authorities so respectable, that it is impossible to deny it; but the question is, how to believe it.' (*Mém. Hist. Lit. et Anecdot.*, &c., par le Baron de Grimm, tom. iii., p. 56, ed. Lond., 1813.) The baron spoke of it precisely as he might have spoken of one of the miracles of the New Testament. Immanuel Kant sifted another of these stories to the bottom, and declared that 'Professor Schlegel had informed him that it could by no means be doubted;' and added, 'they set the assertion respecting Swedenborg's extraordinary gift beyond all possibility of doubt.' (*Darstellung des Lebens und Charakters Immanuel Kants*, Königsberg, 1804.) Swedenborg however laid no stress on such proofs, 'because,' said he, 'they compel only an external belief, but do not convince the internal.' During his latter years, Bishop Filenius and Dr. Ekebon instigated a prosecution against him in the consistory of Göttenburg, whence it was transferred to the diet. Dr. Ekebon denounced his doctrines as 'full of the most intolerable fundamental errors, seducing, heretical, and captious;' and stated furthermore, that he 'did not know Assessor Swedenborg's religious system, and would take no pains to come at the knowledge of it.' Swedenborg came out of these trials with safety, unaccused by the diet, and protected by the king. Towards Christmas, 1771, while in London, he had a stroke of the palsy, from which he never perfectly recovered. A report has been circulated that he recanted his claims during his last illness, but this is a mistake. M. Ferelius, minister of the Swedish Lutheran church in London, who visited him on his death-bed, and administered the sacrament to him, wrote as follows (the 31st March, 1780) to Professor Trätgard of Greifswalde: 'I asked him if he thought he was going to die, and he answered in the affirmative: upon which I requested him,

since many believed that he had invented his new theological system merely to acquire a great name (which he had certainly obtained), to take this opportunity of proclaiming the real truth to the world, and to recant either wholly or in part what he had advanced; especially as his pretensions could now be of no further use to him. Upon this Swedenborg raised himself up in bed, and, placing his hand upon his breast, said with earnestness, "Everything that I have written is as true as that you now behold me: I might have said much more had it been permitted me. After death you will see all, and then we shall have much to say to each other on this subject."' (Ferelius, *Ueber Swedenborg's Ende*, in Tafel's *Leben*.) Swedenborg died at London, in Great Bath Street, Coldbath Fields, on the 29th of March, 1772, in the eighty-fifth year of his age. His body was buried in the Swedish church in Ratcliff Highway.

The following is a list of his theological works:—1, 'Arcana Coelestia,' 8 vols. 4to., London, 1749 to 1756; 2, 'An Account of the Last Judgment and the Destruction of Babylon;' 3, 'On Heaven and Hell;' 4, 'On the White Horse mentioned in the Apocalypse;' 5, 'On the Earths in the Universe;' 6, 'On the New Jerusalem and its Heavenly Doctrine,' 4to., London, 1758; 7, 'The Four leading Doctrines of the New Church—on the Lord, on the Holy Scriptures, on Life, and on Faith;' 8, 'A continuation of the Account of the Last Judgment;' 9, 'On the Divine Love and Wisdom,' 4to., Amsterdam, 1763; 10, 'On the Divine Providence,' 4to., Amst., 1764; 11, 'Apocalypse Revealed,' 4to., Amst., 1766; 12, 'Delights of Wisdom concerning Conjugial Love, and Pleasures of Insanity concerning Scortatory Love,' 4to., Amst., 1768; 13, 'On the Intercourse between the Soul and Body,' 4to., London, 1769; 14, 'A brief Exposition of the Doctrine of the New Church,' 4to., Amst., 1769; 15, 'True Christian Religion,' 4to., London, 1771. As a specimen of Swedenborg's interpretation of the Holy Scripture, the reader may consult the 'Apocalypse Revealed;' for a concise view of his alleged experiences, the 'Heaven and Hell' may be resorted to; for a view of that part of his system which relates to the creation and government of the universe, we recommend the perusal of the 'Divine Love' and 'Divine Providence;' for his doctrine concerning the relation of the sexes, and its eternal origin and perpetuity, and for his code of spiritual legislation on marriage and divorce, see the 'Conjugial Love,' one of the most remarkable of these works: finally, the student will find a compendium of the whole of the theology of the New Church in the 'True Christian Religion,' the last and perhaps the finest of the writings of Swedenborg. The whole of these works, originally published in Latin, have been translated into English, and some of them have passed through several editions both in England and in America. The translations are contained in about thirty octavo volumes.

Swedenborg's Theological MSS., which are preserved in the Royal Academy at Stockholm, are very voluminous. The following have been published:—'Coronis ad veram Christianam Religionem,' 4to., Lond., 1780; 'Apocalypsis Explicata,' 4 tom. 4to., Lond., 1785, 6, 8, 9; 'Index Rerum in Apocalypsi Revelatarum,' 1813; 'Index Verborum, &c. in Arcanis Cœlestibus,' 1815; 'Doctrina de Charitate,' 8vo., Lond., 1840; 'De Domino,' 8vo., Lond., 1840; 'Canones Novæ Ecclesiæ,' 8vo., Lond., 1840; 'Adversaria in Libros Veteris Testamenti,' fasc. i. and ii., Tübingen, 1840-41. Among his yet unpublished papers is that called his 'Diarium,' an unreserved record of his experiences, ranging over a period of sixteen years. The first two volumes of this extensive work are missing, but the third and largest is in the possession of the 'Society for Printing and Publishing the Writings of E. Swedenborg, instituted in London in 1810;' and whenever it is published, it may afford some data for that which is at present unattainable, a theological biography of the author.

Swedenborg did not lay claim to inspiration, but to an opening of his spiritual sight, and a rational instruction in spiritual things, which was granted, as he said, 'not for any merit of his,' but to enable him to convey to the world a real knowledge of the nature of heaven and hell, and thus of man's future existence. According to Swedenborg, heaven and hell are not in space, but they are internal and spiritual states, so that intromission into the spiritual world is only the opening of an interior consciousness. The outward face of the spiritual world resembles that of the natural world in every particular, and man's spiritual body appears precisely similar to his natural body; but the difference is, that all the objects of the spiritual world represent, and change with, the spiritual states of its inhabitants; the magnificent objects in the heavens being actually determined according to the good affections of the angels; and the terrible appearances in the hells being an outbirth of the evil and falsity of the infernals. Heaven and hell are from mankind, and all angels and devils have once been men, either on this or other planets, for all the planets are inhabited, since the human race, and the formation of heaven therefrom, is the final end of creation. The Satan and Devil of Holy Scripture is not a person, but a collective name of hell. The 'last judgment mentioned in the Gospels' does not mean the destruction of the world, which, like every divine work, has respect to infinity and eternity, and will endure for ever, but 'a judgment in the spiritual world, since all who die are gathered together there, and since it is man's *spirit* which is judged.' This judgment commences for every individual immediately after death. Judgment is carried into effect on a church when its charity is extinct, and faith alone remains, and such judgment is attended by a plenary separation of the good from the evil, that is, by a formation of new heavens and new hells, and followed by the institution on earth of a new church. The judgment on the first Christian church took place in the year 1757 (so Swedenborg informs us), and was witnessed by him in the spiritual world, after which commenced the descent from the new heaven of the new church and its doctrine, signified by the Apocalyptic New Jerusalem. The particulars of the faith of this church on the part of man are: 1, 'That there is one God; that there is a Divine Trinity in Him, and that He is the Lord God and Saviour Jesus Christ. 2, That saving faith consists in believing on Him. 3, That evil actions ought not to be done, because they are of the devil, and from the devil. 4, That good actions ought to be done, because they are of God and from God. 5, And that they should be done by man, *as of himself;* nevertheless under the belief that they are from the Lord, operating in him and by him. The two first particulars have relation to faith; the two next, to charity; and the last, to the conjunction of charity and faith, and thereby of the Lord and man.' Concerning the Word of God, Swedenborg taught that in its origin it is the divine truth itself, infinite in the Lord; that in proceeding through the three heavens, it is accommodated to the recipiency of the angels by successive veilings; that in the highest heaven it puts on an appearance accommodated to angelic affections, and is there read in its celestial sense; in the middle and lower heavens, it is clothed by forms adequate to the intelligence and knowledge of the angels there, and is read in its spiritual sense; and in the church, it is presented in a natural and historical form, which is adapted to the understandings of men on earth. This last form thus contains, and corresponds to, a spiritual and celestial form or meaning, which Swedenborg declares he was taught by the Lord in the spiritual world, and which he unfolded at length in his great work, the 'Arcana Cœlestia.' 'The Books of the Word,' says Swedenborg, 'are all those that have the internal sense; but those which have not the internal sense are not the Word. The Books of the Word in the Old Testament are the five Books of Moses; the Book of Joshua; the Book of Judges; the two Books of Samuel; the two Books of Kings; the Psalms; the Prophets Isaiah and Jeremiah; the Lamentations; the Prophets Ezekiel, Daniel, Hosea, Joel, Amos, Obadiah, Jonah, Micah, Nahum, Habakkuk, Zephaniah, Haggai, Zechariah, and Malachi. In the New Testament, Matthew, Mark, Luke, John, and the Apocalypse.' Although the writings of Paul and the other apostles are not in this list, and are described by Swedenborg, in a letter to Dr. Beyer, to be 'dogmatic (or doctrinal) writings merely, and not written in the style of the Word;' yet in the same letter he says, 'Nevertheless the Writings of the Apostles are to be regarded as excellent books, and to be held in the highest esteem, for they insist on the two essential articles of charity and faith in the same manner as the Lord himself has done in the Gospels and in the Apocalypse.' [SWEDENBORGIANS.]

Swedenborg was a methodical man, and laid down certain rules for the guidance of his life. These are found written in various parts of his MSS. as follows:—'1. Often to read and meditate on the word of God. 2. To submit everything to the will of Divine Providence. 3. To observe in everything a propriety of behaviour, and always to keep the con-

science clear. 4. To discharge with fidelity the functions of his employment and the duties of his office, and to render himself in all things useful to society.' On these precepts he formed his character. Count Hopken, prime minister of Sweden, says of him, 'I have not only known Swedenborg these two-and-forty years, but some time since frequented his company daily: I do not recollect to have ever known any man of more uniformly virtuous character.' Sandel says, 'He was the sincere friend of mankind, and, in his examination of the character of others, he was particularly desirous to discover in them this virtue, which he regarded as an infallible proof of many more. As a public functionary he was upright and just: he discharged his duty with great exactness, and neglected nothing but his own advancement. He lived in the reigns of many princes, and enjoyed the particular favour and kindness of them all. He enjoyed most excellent health, having scarcely ever experienced the slightest indisposition. Content within himself, and with his situation, his life was in all respects one of the happiest that ever fell to the lot of man.' Swedenborg was never married. He was about five feet nine inches high, rather thin, and of a brown complexion: his eyes were of a brownish-grey, nearly hazel, and somewhat small. He was never seen to laugh, but always had a cheerful smile on his countenance. 'Many would suppose,' says Ferelius, 'that assessor Swedenborg was a very eccentric person; but, on the contrary, he was very agreeable and easy in society, conversed on all the topics of the day, accommodated himself to his company, and never alluded to his principles unless he was questioned: in which case he answered freely, just as he wrote of them. But if he observed that any one put impertinent questions, or designed to trifle with him, he answered in such a manner that the querist was silenced without being satisfied.' (Ferelius in Tafel's *Leben.*)

(For further particulars the reader may consult Sandel's *Eulogium to the Memory of Swedenborg*, pronounced Oct. 7, 1772, translation, London, 1834; *Documents concerning the Life and Character of E. Swedenborg*, collected by Dr. I. F. I. Tafel, Tübingen, and edited in English by Rev. I. H. Smithson, London, 1841; *Life of Swedenborg, with an Account of his Writings*, by Hobart, Boston, U. S., 1831; Tafel's *Swedenborg's Leben*, now in the press; *The New Jerusalem Magazine*, 1790-91; F. Walden's *Assessor Svedenborg's Levnet, Adskillige Udtog af summes skrivter nogle blandede Tanker, tilligemed Svedenborg's System i kort udfog*, Kiobenhaven, 1806 and 1820; Lagerbring, *Sammandrag af Swea-Rikes Historia*, 8vo., Stockholm, 1778-80.)

SWEDENBORGIANS, the people who believe in the mission of Emanuel Swedenborg to promulgate the doctrines of the New Church, signified by the New Jerusalem in the Apocalypse. [SWEDENBORG.] In this country they may be divided into two portions, one of which forms the denomination known as such to the world; while the other portion remains without visible separation from the communion of the Established Church. The first public association of the Swedenborgians took place in 1788, in Great Eastcheap, London; since that time, societies have been formed in nearly all our large towns, until they now amount to between forty and fifty. These send delegates to an annual conference, which publishes the 'Intellectual Repository,' a periodical of thirty years standing, devoted to the cause. In the United States of America the members of the New Jerusalem Church are numerous and well organised; they have three distinct annual conventions, of which that for the Eastern States meets at Boston; that for the Southern, at Philadelphia; and that for the Western, at Cincinnati; and they publish four different Swedenborgian periodicals. In France the doctrines of Swedenborg have excited much attention, partly through the writings of his eloquent disciple Richer, of Nantes; and through the French translations of Swedenborg's works, which were executed by J. P. Moet, and published by John Augustus Tulk. In Germany, Swedenborg has long had isolated readers, of whom the most celebrated is the librarian to the king of Würtemberg, Dr. I. F. I. Tafel, known through Germany for his learned editions of the original works of Swedenborg, for his translations of the same, and for the elaborate works he has published in their defence. In Sweden, bishops and doctors of the Lutheran church have favoured the claims of Swedenborg: a writer (Haldane) on the state of religion there gives it as one sign 'of the pernicious spirit of the times,' that 'Swedenborgianism makes rapid progress among all classes of society.' Swedenborgianism has also taken deep root in several of the British Colonies. There is more than a suspicion that the initiators of the new Oxford theology (the editor of Froude's 'Remains,' and others) were acquainted with the early readers of Swedenborg; and that hence originally came their repudiation of the fundamental Protestant doctrine of justification by faith alone.

The non-separatist Swedenborgians comprise many members, and even clergymen, of the Church of England. The Rev. Thomas Hartley, rector of Winwick, in Northamptonshire, the Rev. John Clowes, rector of St. John's, Manchester, and the Rev. William Hill, are the first translators of the large works of Swedenborg. The chief works in English in recommendation and in defence of his doctrines are those of Clowes and Hindmarsh; Noble's 'Appeal in Behalf of the Doctrines of the New Church' and 'Plenary Inspiration of the Sacred Scriptures;' Clissold's 'Letter to the Archbishop of Dublin on the practical Nature of the Doctrines and alleged Revelations of Swedenborg,' and 'Illustrations of the End of the Church, as predicted in Matthew, c. xxiv., with Remarks on the Time of the End,' London, 1841. The Swedenborgians have several public institutions, the most flourishing of which is that entitled the 'Society for printing and publishing the Writings of Emanuel Swedenborg, instituted in London in 1810,' which annually prints and circulates a great number of his works.

There is also a London Missionary and Tract Society, and Tract Societies at Bath, Birmingham, Glasgow, and Manchester. That at Manchester circulates nearly a hundred thousand tracts in the year. There are two Liturgies in general use among the Swedenborgians: 1, The 'Book of Worship,' Boston, United States, embodying a very simple form of worship, consisting chiefly of passages from the Scripture, and chants from the Psalms; 2, The 'Liturgy of the New Church, prepared by order of the General Conference,' London, which is used throughout this country, and contains a more formal service than that adopted in America. From the latter we may conveniently borrow the twelve 'Articles of Faith,' 'condensed,' as they are, 'from the Writings of Swedenborg, adopted by the General Conference, and recognised as a standard of Doctrine by the whole body of Swedenborgians.'

'The Articles of Faith of the New Church signified by the New Jerusalem in the Revelation, are these:—

'1, That Jehovah God, the creator and preserver of heaven and earth, is love itself and wisdom itself, or good itself and truth itself: that he is one both in essence and in person, in whom, nevertheless, is the Divine Trinity of Father, Son, and Holy Spirit, which are the essential divinity, the divine humanity, and the divine proceeding, answering to the soul, the body, and the operative energy in man; and that the Lord and Saviour Jesus Christ is that God.

'2, That Jehovah God himself descended from heaven, as divine truth, which is the Word, and took upon him human nature, for the purpose of removing from man the powers of hell, and restoring to order all things in the spiritual world, and all things in the church: that he removed from man the powers of hell, by combats against and victories over them; in which consisted the great work of redemption: that by the same acts, which were his temptations, the last of which was the passion of the cross, he united, in his humanity, divine truth to divine good, or divine wisdom to divine love, and so returned into his divinity in which he was from eternity, together with, and in, his glorified humanity; whence he for ever keeps the infernal powers in subjection to himself: and that all who believe in him, with the understanding, from the heart, and live accordingly, will be saved.

'3, That the Sacred Scripture, or Word of God, is divine truth itself, containing a spiritual sense heretofore unknown, whence it is divinely inspired and holy in every syllable; as well as a literal sense, which is the basis of its spiritual sense, and in which divine truth is in its fulness, its sanctity, and its power: thus that it is accommodated to the apprehension both of angels and men: that the spiritual and natural senses are united, by correspondences, like soul and body, every natural expression and image answering to, and including, a spiritual and divine idea; and thus that the Word is the medium of communication with heaven and of conjunction with the Lord.

'4, That the government of the Lord's divine love and wisdom is the divine providence; which is universal, exer-

cised according to certain fixed laws of order, and extending to the minutest particulars of the life of all men, both of the good and of the evil: that in all its operations it has respect to what is infinite and eternal, and makes no account of things transitory but as they are subservient to eternal ends: thus, that it mainly consists, with man, in the connexion of things temporal with things eternal; for that the continual aim of the Lord, by his divine providence, is to join man to himself and himself to man, that he may be able to give him the felicities of eternal life: and that the laws of permission are also laws of the divine providence; since evil cannot be prevented without destroying the nature of man as an accountable agent; and because, also, it cannot be removed unless it be known, and cannot be known unless it appear: thus, that no evil is permitted but to prevent a greater; and all is overruled, by the Lord's divine providence, for the greatest possible good.

'5, That man is not life, but is only a recipient of life from the Lord, who, as he is love itself and wisdom itself, is also life itself; which life is communicated by influx to all in the spiritual world, whether belonging to heaven or to hell, and to all in the natural world; but is received differently by every one, according to his quality and consequent state of reception.

'6, That man, during his abode in the world, is, as to his spirit, in the midst between heaven and hell, acted upon by influences from both, and thus is kept in a state of spiritual equilibrium between good and evil; in consequence of which he enjoys free will, or freedom of choice, in spiritual things as well as in natural, and possesses the capacity of either turning himself to the Lord and his kingdom, or turning himself away from the Lord and connecting himself with the kingdom of darkness: and that, unless man had such freedom of choice, the Word would be of no use; the church would be a mere name; man would possess nothing by virtue of which he could be conjoined to the Lord; and the cause of evil would be chargeable on God himself.'

'7, That man at this day is born into evil of all kinds, or with tendencies towards it: that, therefore, in order to his entering the kingdom of heaven, he must be regenerated or created anew: which great work is effected in a progressive manner, by the Lord alone, by charity and faith as mediums, during man's co-operation: tha as all men are redeemed, all are capable of being regenerated, and consequently saved, every one according to his state; and that the regenerate man is in communion with the angels of heaven, and the unregenerate with the spirits of hell: but that no one is condemned for hereditary evil, any further than as he makes it his own by actual life; whence all who die in infancy are saved, special means being provided by the Lord in the other life for that purpose.

'8, That repentance is the first beginning of the church in man; and that it consists in a man's examining himself, both in regard to his deeds and his intentions, in knowing and acknowledging his sins, confessing them before the Lord, supplicating him for aid, and beginning a new life: that, to this end, all evils, whether of affection, of thought, or of life, are to be abhorred and shunned as sins against God, and because they proceed from infernal spirits, who in the aggregate are called the Devil and Satan; and that good affections, good thoughts, and good actions are to be cherished and performed, because they are of God and from God: that these things are to be done by man as of himself; nevertheless, under the acknowledgment and belief that it is from the Lord, operating in him and by him: that so far as man shuns evils as sins, so far they are removed, remitted, or forgiven: so far also he does good, not from himself, but from the Lord; and in the same degree he loves truth, hath faith, and is a spiritual man: and that the Decalogue teaches what evils are sins.

'9, That charity, faith, and good works are unitedly necessary to man's salvation: since charity, without faith, is not spiritual, but natural; and faith, without charity, is not living, but dead; and both charity and faith, without good works, are merely mental and perishable things, because without use or fixedness: and that nothing of faith, of charity, or of good works is of man, but that all is of the Lord, and all the merit is his alone.

'10, That Baptism and the Holy Supper are sacraments of divine institution, and are to be permanently observed: baptism being an external medium of introduction into the church, and a sign representative of man's purification and regeneration; and the Holy Supper being an external medium, to those who receive it worthily, of introduction, as to spirit, into heaven, and of conjunction with the Lord; of which also it is a sign and seal.

'11, That immediately after death, which is only a putting off of the material body, never to be resumed, man rises again in a spiritual or substantial body, in which he continues to live to eternity: in heaven, if his ruling affections, and thence his life, have been good; and in hell, if his ruling affections, and thence his life, have been evil.

'12, That *now* is the time of the second advent of the Lord, which is a coming, not in person, but in the power and glory of his Holy Word: that it is attended, like his first coming, with the restoration to order of all things in the spiritual world, where the wonderful divine operation, commonly expected under the name of the Last Judgment, has in consequence been performed; and with the preparing of the way for a New Church on the earth,—the first Christian Church having spiritually come to its end or consummation, through evils of life and errors of doctrine, as foretold by the Lord in the Gospels: and that this New or Second Christian Church, which will be the Crown of all Churches, and will stand for ever, is what was representatively seen by John, when he beheld the holy city, New Jerusalem, descending from God out of heaven, prepared as a bride adorned for her husband.'

(For further particulars see *Reports of the Society for Printing and Publishing the Writings of the Hon E. Swedenborg*, London, n. i. to xxxii. (1810 to 1841), *Reports of the London Missionary and Tract Society of the New Jerusalem Church*, n. i. to xxi. (1821 to 1841); *Minutes of the General Conference of the New Church, signified by the New Jerusalem in the Revelation*, 1789 to 1841; also Tafel's *Magazin für die wahre Christliche Religion*, pp. 1 to 70, Tübingen, 1841, which contains an elaborate account of all the Swedenborgian periodicals.)

SWEDISH TURNIP. [Turnips.]

SWEET BRIAR [Rosa, p. 158.]

SWEET CALAMUS. Reference has been made from Nardus and Schœnanthus to Spikenard, and to this article from Spikenard, because under this name two very different substances have been confounded in modern times, though they were known to be distinct by the antients. The aromatic which was of equal celebrity with Spikenard, mentioned by the same authors and procured from the same country, is described by Dioscorides under the name of κάλαμος ἀρωματικός. It is supposed by Sprengel and some authors that the Acorus Calamus of botanists is intended, which is possessed of slight aromatic properties, is common in European ditches, and is likewise found in India in mountainous situations. This is known to the Arabs by the name *waj*, which appears to be a corruption of the Hindee *buch*, Sanscrit *vacha*, and has in the Arabian works the name *akoron* assigned as its Greek synonyme, no doubt intended for the ἄκορον of Dioscorides. Therefore there is no foundation for the opinion of Sprengel that this Acoron is the Iris pseudacorus of botanists.

Calamus aromaticus is described by Dioscorides immediately after σχοῖνος or σχῖνος, which is usually translated Juncus odoratus, and is acknowledged to be the Andropogon Schœnanthus of botanists, commonly known by the name of Lemon-Grass. This has also had the names of Camel's Hay, *palea de mecha*, &c. applied to it. Schœnanthus is evidently compounded of Schœnus and Anthos (ἄνθος, 'a flower'). Theophrastus treats of Calamos and Schœnos together, and states that they were found among the mountains of Libanus, on the shores of an extensive lake; but Burckhardt in such situations could only find rushes and reeds. It is possible therefore that a Syrian locality may have been assigned to drugs obtained from more distant countries by the route of the Euphrates, for Dioscorides says they are produced in India. By Hippocrates they are called κάλαμος εὐώδης and Σχοῖνος εὔοσμος, also κάλαμος σχοῖνος (Hipp., f. 5, p. 138, l. 17), evidently showing that if they agreed in properties, they had also some resemblance in nature. If we desire to find something similar to Schœnanthus, and possessed of still more aromatic properties, we have only to search in the genus to which this belongs, and we shall find several plants famous for their agreeable odour. The roots of Andropogon muricatum, commonly known in the shops of this country by the Tamul name *vitivayr*, and made into small bundles for brushing velvet, are remarkable for their fragrance: hence several essences are now prepared from them in Paris. The

roots are also well known to Indians by the name of *Khuskhus*, being used throughout the Bengal Presidency for making tattees; these thatched screens being fitted to doors and windows, have water constantly sprinkled over them; the hot air in passing through becomes much cooled by the great evaporation, and enters the room both cool and refreshing, diffusing a delightful fragrance. The aroma here depends on the presence of a principle analogous to myrrh. But other species are still more fragrant, and secrete odorous volatile oil in sufficiently large quantities to be profitably distilled. Of these, Lemon-Grass, or Andropogon Schœnanthus, is the best known. The infusion of its leaves is often employed in India as a pleasant stomachic, and Lemon-Grass oil is probably distilled from them. A. Nardus? is another species, called Ginger, or Spice-Grass, by Ainslie, which is said by him to be common in the Courtallum Hills and the Indian Peninsula, where the natives occasionally prepare with it an essential oil useful in rheumatism, and use the infusion of its leaves as a stomachic. A. Iwarancusha is a species which comes near A. Schœnanthus in habit and taste. It skirts the bases of the mountains of north-west India, and was found by Dr. Blane and by Dr. Boyd about Hurdwar: it was considered by the former to be the spikenard of the antients. Dr. Royle also found it near Hurdwar, and in the upper parts of the Doab of the Ganges and Jumna rivers, and he states (*Illustr. Himal. Bot.*, p. 425) that it is there called *mirchia-gund*, with *izkhir* given as its Arabic, and *iskhinos* as its Greek synonyme; and infers that it may have been the σχῖνος of the Greeks as well as A. Schœnanthus. But another species is still more extensively diffused, and still more remarkable for its very powerful and delightful fragrance. This is the species which yields the Grass-Oil of Central India, commonly called Oil of Spikenard. It extends southwards to between the Godavery and Nagpore, and northwards to the Delhi territory, but probably still farther north, as it delights in a dry and barren soil. In Central India, especially at Namur, Ellichpore, &c., a very delightful fragrant oil is distilled from this plant, which is highly valued in the East as a scent, being added to the finer expressed oils employed for anointing the hair or the bodies of the natives. It is also much esteemed as an external application in rheumatism, and has been introduced into practice in this country, and is highly valued by some, though unknown to the generality of practitioners. It has the advantage of diffusing an agreeable odour at the same time that it is efficaceous as a stimulant remedy. This or the preceding species extends into Afghanistan.

Sweet Cane, or Calamus, being described by Dioscorides immediately after σχῖνος, which is generally acknowledged to be Andropogon Schœnanthus, appears to Dr. Royle to belong to the same genus, and indeed to be the above far-famed species, as Calamus aromaticus is thought also to be the 'sweet cane' and the rich aromatic reed from 'a far country' of Scripture: he states there is no plant which more closely coincides in description with everything that is required, than the tall grass which yields the fragrant grass-oil of Central India, and which he has named Andropogon Calamus aromaticus. (*Illustr. Himal. Botany*, p. 425.)

SWELL. [ORGAN.]

SWIETEN, GERARD VAN, was born at Leyden in 1700. He received his general education there and at Louvain, and studied medicine at Leyden under Boerhaave, of whom he soon became the favourite pupil, and by whose influence he was appointed to a professorship of medicine very soon after taking his diploma of doctor in 1725. His lectures were well attended, but objections were made against him on the ground of his being a Roman Catholic, and he was obliged to resign his chair. In 1745 Maria Theresa of Austria appointed him her first physician, and in this capacity he used his influence to establish a system of clinical instruction at Vienna, to rebuild the university, and accomplish many other important measures for the advancement of science. During eight years also he lectured on the 'Institutes' of Boerhaave. He died in 1772, and Maria Theresa, who, besides many other honours, had made him a baron of the empire, had a statue to his memory placed in the hall of the university.

Van Swieten was one of the few great physicians of his day, who, though he founded a school (and that one of the most important of the time), did not attempt to establish himself as the head of a sect. He was content to adopt the system of Boerhaave; in his commentaries on whose aphorisms he has embodied the results of a most extensive experience in clinical medicine, and has shown himself to have been a physician of great erudition and of some practical merit. The work is entitled 'Commentaria in Hermanni Boerhaavii Aphorismos de cognoscendis et curandis morbis:' it was first published at Leyden, in 5 volumes, 4to., between 1741 and 1772; and has since been repeatedly edited in Latin, English, French, and German. It consists of long commentaries, not only on each aphorism, but on every portion of each of them. To confirm their truth he introduces passages from the writers of all preceding times and countries, and relates numerous cases from his own and their practice. Van Swieten wrote treatises also on the diseases of armies, on epidemics, and on the structure and offices of arteries; but they are of little importance in comparison with his commentaries, and are now seldom referred to. He maintained also a long opposition against the practice of inoculating small-pox. (*Biographie Médicale.*)

SWIETE'NIA, a small genus of plants of the natural family Cedrelaceæ, named by Jacquin in honour of G. van Swieten. The genus Swietenia is characterised by having a small 4-5-cleft calyx; petals 4 to 5, deciduous; stamens 8 to 10, the filaments united together into a toothed tube, bearing the anthers on the inside; stigma peltate; ovary 5-celled, seated on a stipes; seeds winged. The species, though few in number, are found in hot parts of the world, form large trees, and yield valuable timber.

S. febrifuga of Roxburgh has been formed into a new genus SOYMIDA. S. Senegalensis has also been formed into a new genus, Khaya, and is the tree yielding African mahogany, which is brought to us from Sierra Leone. The timber, though hard, is liable to warp, but it is employed where a hard and cheap wood of large size is required, as for mangles. The negroes employ an infusion of the bark, which is very bitter, as a febrifuge. S. chloroxylon is a third species, which has been formed into a new genus, and is now Chloroxylon Swietenia, a native of the mountainous parts of the Circars in the East Indies. It is the tree yielding the beautiful East Indian satin-wood, which is of a deep yellow colour, close-grained, heavy, and durable. S. Chikrassee, now Chikrassia tabularis, is a fourth species, formed into a new genus. This is another Indian tree which is greatly admired for its beauty: the wood is very light coloured, close-grained, and most elegantly veined, and much employed for furniture and cabinet-work. The most important species however, and that which now nearly alone constitutes the genus, is Swietenia mahogany, a native of Campeachy and of the West Indies. It is a lofty branching tree with a large spreading head, and pinnate shining leaves. The timber, which is so well known from its extensive employment for furniture and cabinet-making, is of a reddish or yellowish-brown colour, of different degrees of brightness, much mottled and streaked, very little liable to shrink or warp, free from taste or smell, except when kept for some time, when it acquires an agreeable odour, from the exudation of a semi-resinous juice, which serves to preserve the wood from the attacks of insects. It does not appear to have been imported into this country before 1724. The quality of the wood varies much, according to the situations in which it grows: that which is produced on rocky soil and exposed situations is the best. Spanish mahogany is imported in logs of about 10 feet long, and from 20 to 26 inches square. From the elevated parts of the West Indies and from the Spanish Main the wood is close-grained, and of a darker colour than the Honduras mahogany. This is imported in logs of from 2 to 4 feet square, though both kinds are no doubt produced by the same tree. A few years ago the Messrs. Broadwood gave the large sum of 3000*l.* for three logs of mahogany, which were each about 15 feet long and 38 inches square. The wood was extremely beautiful, and capable of taking the highest polish.

SWIFT, JONATHAN, D.D., Dean of St. Patrick's cathedral, Dublin, was descended from an antient family which was originally settled in Yorkshire. His grandfather, the Rev. Thomas Swift, was vicar of Goodrich, in Herefordshire; he had ten sons, Godwin, Thomas, William, Dryden, Willoughby, Jonathan, Adam, and three others, of whom Godwin, William, Jonathan, and Adam settled in Ireland; he had also four daughters. Dryden was named after his mother, who was a near relation of Dryden the poet. Jonathan was the father of the dean of St. Patrick's; he married Abigail Erick, of an antient family in Leicestershire, but poor. He was bred to the law, and in 1665 was appointed

steward of the King's Inns, Dublin. He died in 1667, leaving his widow in great poverty, with an infant daughter, and pregnant with the future dean of St. Patrick's.

Jonathan Swift was born in Dublin, November 30, 1667. When about a year old, he was carried to Whitehaven, in Cumberland, by his nurse, who went there to receive a legacy; he remained with her in that town nearly three years, and she had taught him to spell before he was taken back to his mother in Dublin. Mrs. Swift's means of support for herself and her two children were derived chiefly from her brother-in-law Godwin, who was a lawyer, and was supposed to be rich. Jonathan, when six years old, was sent to the school of Kilkenny, whence he was removed to Trinity College, Dublin, where he was received as a pensioner, April 24, 1682. The cost of his education and maintenance was defrayed by his uncle Godwin, who however supplied him with the means of subsistence in so niggardly and ungracious a manner, that Swift ever afterwards spoke of him with great asperity. Before Swift's education was completed, Godwin died, and it was then discovered that he had for some time been in embarrassed circumstances, the result of unsuccessful speculations. The charge of Swift's education now devolved chiefly upon his uncle William, of whom he always spoke with affectionate gratitude as 'the best of his relations;' not that he was much more liberally supplied with money than he had been by Godwin, for William also was in difficulties, but for the kindness with which it was bestowed. The degree of B.A. was conferred on Swift, February 15, 1785: this was done, as he himself says, *speciali gratiâ*, which, he informs us, was, in Trinity College, a discreditable intimation of scholastic insufficiency. Indeed there is abundant evidence that he had not only neglected the study of the school logic which was then required in order to qualify him for taking a degree, but that, after he had taken his degree, as well as before, his conduct generally was careless, irregular, and reckless, and that he incurred frequent penalties and censures. It is probable however that he had a scholarship in Trinity College, for he remained there till 1688, when, on the breaking out of the war in Ireland, he passed over into England, and travelled on foot to Leicester, where his mother had been residing for some years in a state of precarious dependence on her relations, one of whom was the wife of Sir William Temple, whose seat was Moor Park, near Farnham, in Surrey.

Swift, after residing some months with his mother, waited upon Sir William Temple, by whom he was received with kindness, and was admitted into his family. From this time Swift's careless and idle habits were entirely abandoned; he studied eight hours a day, and became useful to his patron as his private secretary. A surfeit of stone-fruit, to which Swift always ascribed the giddiness with which he was afterwards so severely afflicted, brought on an ill state of health, for the removal of which, after he had been about two years with Sir William, he went to Ireland, but soon returned. He was now treated with greater kindness than before: he occasionally attended King William, who was a frequent guest at Moor Park, in his walks in the garden, while Temple was laid up with the gout, and won so much on his majesty's favour, that he not only taught him how to cut asparagus in the Dutch manner, but offered to make him captain of a troop of horse, which however Swift declined. Sir William employed him to endeavour to persuade the king to consent to the bill for triennial parliaments, and Swift's vanity was much hurt when he found that his reasoning was not sufficiently strong to overcome the king's obstinacy.

Swift went to Oxford in 1692, and entered himself of Hart Hall, for the purpose of taking his degree of M.A., to which he was admitted on the 4th of July in that year, together with Thomas Swift (the son of his uncle Thomas), who had studied with Jonathan at Trinity College, Dublin, and was afterwards rector of Puttenham in Surrey. Some time after his return to Moor Park, finding that no provision was made for him beyond subsistence in Sir William's family, Swift became tired of his state of dependence, and in some degree dissatisfied with his patron. He made his complaint to Sir William, who then offered him a situation worth 100*l.* a year in the Rolls in Ireland, of which Sir William was Master. Swift declined the offer, and said he preferred going to Ireland and endeavouring to obtain preferment in the church. They were both displeased, and so parted. Swift went to Ireland, but was deeply mortified when he found that he could not obtain orders without a certificate from Sir William, which he was therefore compelled to solicit from his offended patron. The certificate was given; Swift was admitted to deacon's orders, October 18, 1694, and to priest's orders, January 13, 1695. Soon afterwards Lord Capel, then lord-deputy of Ireland, bestowed upon him the prebend of Kilroot, in the diocese of Connor, worth about 100*l.* a year, whither he immediately went to perform the duties of a country clergyman.

Sir William Temple appears to have soon felt the want of Swift's services, and it was not long before he sent him a kind letter, with an invitation to return to Moor Park. Swift, on the other hand, however fond of independence, must have felt strongly the contrast between the dull life of a clergyman in a remote town in Ireland and the refined society of Moor Park. He did not hesitate long to accept Sir William's invitation; and having become acquainted with a learned and worthy curate in his neighbourhood, who had a family of eight children, and only 40*l.* a year, he rode to Dublin, resigned his prebend, and obtained a grant of it for his poor friend.

Swift, on his return to Moor Park in 1695, was treated by Sir William Temple rather as a friend than as a mere secretary, and they continued to live together till Sir William's death, January 27, 1698. Some time before his death, Temple had obtained from King William a promise that Swift should have a prebend of Canterbury or Westminster: Sir William also left him a legacy, with the task of editing his posthumous works, and any benefit which might arise from the publication of them.

During the early part of his residence at Moor Park, Swift wrote some Pindaric Odes, which he is said to have shown to Dryden, who, after having read them, said, 'Cousin Swift, you will never be a poet;' a remark which is supposed to have occasioned that feeling of dislike which Swift always manifested towards Dryden. These Odes are written in the style of the Pindaric Odes of Cowley, and are indeed bad imitations of a bad model. Swift also wrote, as he himself has stated, a great number of other things, nearly all of which he destroyed. During the latter part of his residence at Moor Park he wrote 'The Battle of the Books in St. James's Library,' in support of Sir William Temple, and in opposition to Dr. William Wotton and Dr. Bentley. A dispute had arisen in France as to the superiority of antient or of modern writers: the dispute passed over to England, and the cause of the moderns was supported by Wotton, in his 'Reflections on Antient and Modern Learning.' Temple took the part of the antients, but unfortunately praised the 'Epistles of Phalaris,' which Bentley, in an Appendix to the second edition of Wotton's 'Reflections,' proved to be spurious. Swift's work is a well-constructed allegory, abounding in wit and humour. It was not published however till after Sir William's death. Swift is supposed to have likewise finished about this time his 'Tale of a Tub,' a satirical allegory, in ridicule of the corruptions of the church of Rome and the errors of the dissenters, and in favour of the church of England, though not without an occasional touch at her faults also. This is one of his most laboured and most perfect works. Though he completed it at Moor Park, there is evidence that he had sketched it out roughly at Trinity College.

It was during Swift's second residence at Moor Park that the acquaintance commenced between him and Miss Esther Johnson, more generally known by the poetical name which he gave to her of *Stella* (the Star). Her father was a London merchant, according to Scott, or steward to Sir William Temple, according to Sheridan. He might have been both—unfortunate in business, and Sir William's steward afterwards. He died soon after Stella's birth. Her mother lived with Lady Gifford, Sir William Temple's sister, who, with Mrs. Johnson and her daughter, resided at this time at Moor Park. Miss Johnson was then about thirteen years of age, and Swift about thirty. He assisted in her education, which appears to have been little attended to previously, and she seems to have acquired a fondness for her tutor.

Swift however, some years previously to his acquaintance with Miss Johnson, had professed an attachment to Miss Jane Waryng, on whom he bestowed the title of *Varina*: she was the sister of a fellow-student at Trinity College, and Swift offered to marry her; but she was coy and cold, and gave a temporary refusal on the plea of ill health. By degrees, as Swift's passion abated, hers grew warmer, and she wrote to express her willingness to accept his former offer.

Swift did not refuse to fulfil his promise, but in his reply laid down such conditions as to the duties of her who should become his wife. that no further correspondence took place between them.

After Sir William Temple's death Swift repaired to London, to superintend the publication of his patron's posthumous works, a task which he performed carefully, and prefixed a Life of Sir William and a dedication to the king; but, finding that the king took no notice of the Works, the dedication, or himself, he accepted an offer made to him by Lord Berkeley in 1699, who had just been appointed one of the lords justices of Ireland, to attend him there as his chaplain and private secretary. He acted as secretary till they arrived in Dublin, when a person of the name of Bush obtained the office for himself by representing to Lord Berkeley the unsuitableness of such an office to the character and duties of a clergyman. Lord Berkeley however, to compensate Swift for the loss of his office, promised that he should have the first good preferment in his gift that became vacant. To this arrangement Swift assented. The rich deanery of Derry was soon afterwards at Lord Berkeley's disposal, and Swift intimated to him that he expected him to keep his word. Lord Berkeley told him that Bush had obtained the promise of it for another, but, observing Swift's indignation, advised him to apply to Bush to see if the matter could not be arranged: he did so, when the secretary frankly told him that 1000*l.* had been offered for it, but that if he would put down the same sum he should have the preference. Swift, in a rage, exclaimed, 'God confound you both for a couple of scoundrels,' and immediately left the castle, intending to return no more. Lord Berkeley however was unwilling, if it could be avoided, to risk exposure: he therefore offered to him the rectory of Agher and the vicarages of Laracor and Rathbeggan, then vacant, in the diocese of Meath. Though not worth a third of the deanery, as they only amounted together to 230*l.* a year, Swift deemed it prudent to accept the livings: he still retained his office of chaplain, and continued to reside with the family till Lord Berkeley retired from the government of Ireland. The prebend of Dunlavin was bestowed upon him in 1700, which increased his income to between 350*l.* and 400*l.* a year. While he resided in Lord Berkeley's family he produced some of the first specimens of that original vein of humour on which, more perhaps than on any other of his rare talents, his reputation is founded: among these are 'The Humble Petition of Frances Harris,' and the 'Meditation on a Broomstick.'

About this time Swift's sister married a person of the name of Fenton. Swift had expressed himself strongly against this marriage, and when it took place, he was highly offended. Scott, on the authority of Theophilus Swift, says that Fenton was a worthless character, on the point of bankruptcy at the time, and that Swift afforded his sister the means of decent support in the destitution which her imprudence brought upon her.

In the year 1700, on the return of Lord Berkeley to England, Swift took possession of his living at Laracor. He performed his duties as a country clergyman with exemplary diligence, and expended a considerable sum in repairing the church. Some years afterwards he purchased for 250*l.* the tithes of the parish of Effernock near Trim, which he left by his will to the vicars of Laracor for the time being, as long as the present episcopal religion continues to be the established faith in Ireland; but if any other form of Christian religion becomes the established faith, he then directs that the profits as they come in shall be paid to the poor of the parish of Laracor.

Swift had not been long at Laracor when it was arranged between Miss Johnson and himself that she should come to reside in his neighbourhood. She had a small independence, about 1500*l.*, of which 1000*l.* had been left to her as a legacy by Sir William Temple, since whose death she had resided with Mrs. Dingley, a relation of the Temple family, a widow of middle age, whose income was only about 25*l.* a year. Mrs. Johnson continued to reside with Lady Gifford. When Miss Johnson removed to Ireland she was accompanied by Mrs. Dingley; and the ostensible ground for leaving England on the part of both was that the rate of interest was much higher in Ireland: it was then 10 per cent. They took lodgings in the town of Trim, where they generally resided, except in Swift's absence, when they occupied the vicarage-house. Miss Johnson was then about eighteen years of age: her features were beautiful, her eyes and hair black, and her form symmetrical, though a little inclined to fullness. She was a woman of strong sense, though not highly educated, of agreeable conversation, and elegant manners.

Swift appears to have passed over to England at least once a year, and remained two or three months, chiefly in London, where he officiated as chaplain in Lord Berkeley's family, but generally paid a visit to his mother at Leicester. In 1701, during the first of these annual residences in England, he published his first political tract, 'A Discourse on the Contests and Dissentions between the Nobles and Commons at Athens and Rome.' It was intended to check the popular violence which had occasioned the impeachment of Lords Somers, Halifax, Oxford, and Portland for their share in the Partition Treaty. It was published anonymously, but attracted much attention.

On his second visit to England, in 1702, he avowed himself to be the author of this tract, and was immediately admitted into the society of the leading Whigs, Somers, Halifax, and Sunderland, and also into that of the leading wits, Addison, Steele, Arbuthnot, and others, who used then to assemble at Button's coffee-house.

In 1704 Swift published anonymously the 'Tale of a Tub,' together with 'The Battle of the Books.' The 'Tale of a Tub' was at the time generally supposed to be Swift's, and its wit was much admired, but it made him some powerful enemies by its imputed irreligious tendency.

In 1708 Swift was employed by the Irish prelates to solicit a remission of the first fruits for Ireland, which had already been granted in England. [BENEFICE.] His application was made to Lord Godolphin, but was unsuccessful. About this time there were two or three plans for Swift's preferment, but all of them were failures. He was to have accompanied Lord Berkeley as secretary of embassy to Vienna, but Lord Berkeley found himself too infirm to venture upon the employment: he was to have gone out to Virginia as a sort of metropolitan over the colonial clergy in America, but neither did this appointment take place; and he was promised Dr. South's prebend of Westminster, but South, though very old, continued to live for several years longer.

During the years 1708 and 1709 Swift published several tracts. 'An Argument against abolishing Christianity,' is a piece of grave irony; 'A Project for the Advancement of Religion,' was dedicated to Lady Berkeley, who was a woman of strict piety, highly respected by Swift: it is the only work to which he ever put his name: it made a strong impression on the religious classes, and was very favourably received by the public. In his 'Letter on the Sacramental Test' he opposed any relaxation of the restrictive laws against the Dissenters. In this opinion he differed strongly from the Whigs, and this difference seems to have been a principal cause of his soon afterwards joining the Tories. About this time he also published the 'Sentiments of a Church-of-England Man,' as well as some of his lighter pieces, especially the humorous attacks on Partridge the almanac-maker, which came out under the name of Isaac Bickerstaff. In 1710 Swift's mother died. 'If the way to heaven,' said he, 'be through piety, truth, justice, and charity, she is there.'

On the change of ministry in 1710 the hopes of the Irish prelates were again revived for a remission of the first-fruits; and Swift was again deputed, in conjunction with the bishops of Ossory and Killaloe, to solicit the boon. On the 1st of September, 1710, he left Ireland on this mission, but found, on his arrival in London, that the bishops, who had gone to England before him, had left that country without having done anything.

Swift now found himself courted by the leaders of both parties, with the exception of Godolphin, who treated him with such marked coldness that he vowed revenge, a vow which he performed on the 1st of October, by the publication of 'Sid Hamet's Rod.' Swift soon made up his mind to join the Tories, and on the 4th of October was introduced to Harley, then chancellor of the exchequer, by whom he was received with the most flattering kindness, and was introduced by him to St. John, who was then one of the secretaries of state. In a few days he received a promise that the first-fruits should be remitted, and immediately began to put his literary battery in action in the defence of his new friends.

During the time that Swift remained in London on this occasion he wrote a Journal, or diary, which was addressed

in a series of letters to Miss Johnson and Mrs. Dingley, but obviously intended for the former. This Journal, written as it was chiefly in the morning and evening of each successive day of the most busy part of Swift's life, affords a picture as minute as it is evidently trustworthy of the events in which he was concerned and the thoughts which arose out of them.

'The Examiner,' a weekly periodical, had been begun by St. John, Prior, and others, in support of the new ministry. Thirteen numbers had been published with little effect, when it was taken up by Swift, November 10, 1710, and was continued by him till June 14, 1711, a period of seven months, when he resigned it into other hands. Every one of these papers was written by himself, besides several satirical pamphlets. He assailed his opponents not only as a body, but individually: the shafts of his satire were particularly directed against Wharton, Godolphin, Walpole, Sunderland, Cowper, and Marlborough. With surprising readiness and versatility, he assumed every shape suitable for the annoyance of his enemies or the support of his friends.

Harley, who, though he maintained the most friendly and confidential intercourse with Swift, seems not at that time to have properly appreciated his character or understood his views, sent him a note for 50*l*., which Swift indignantly returned, and obstinately refused his invitations till he had made an apology. After the attempt upon the life of Harley by the Marquis de Guiscard, he was created lord treasurer and earl of Oxford, in May, 1711, and offered to make Swift his chaplain, who refused this offer also. 'I will be no man's chaplain alive,' says he in his Journal. He evidently thought that his services and his merits deserved no worse a place than a bishopric. He continued, as long as he remained in England, to be treated, both in private and public, with the most flattering civility, especially by Lord Oxford, and also by St. John, who in July, 1712, was created lord Bolingbroke. He formed the society of Brothers, which consisted of sixteen persons of the highest rank and most distinguished talents among the Tories, of which society indeed he was the most active member.

It having become obvious that the existence of the Tory government depended upon making peace with France, Prior was sent to Paris to enter into a negotiation for that purpose, and Swift, in furtherance of the same object, wrote 'The Conduct of the Allies,' which was published anonymously, November 27, 1711, while the question of peace or war was under discussion in parliament. The sale of this tract was unprecedented at that time, four large editions having been exhausted in a week. It furnished the Tory members in the House of Commons with facts and arguments, while the Whigs in the Lords threatened to bring the author to the bar of the house. The effect upon the public mind was such as to produce a determined spirit of opposition to the war, proving, as it did, that the allies, the late Whig ministry, and especially the duke of Marlborough, were the only parties who had derived advantage from the expenditure of so much English blood and treasure.

The Peace of Utrecht was concluded May 5, 1713, and Swift undertook to write the history of it, but the progress and publication of the work were hindered by the growing dissention between Oxford and Bolingbroke. This work he afterwards expanded into the 'History of the Four last Years of Queen Anne's Reign,' but it was not published till 1758, some years after his death. The only work unconnected with politics which Swift produced during this busy period of his life, was his letter to the earl of Oxford, containing 'A Proposal for correcting, improving, and ascertaining the English Tongue,' an object which was to be accomplished by a society similar to that of the French Academy. Swift was very anxious to have this scheme carried into effect, but Oxford was too busy at that time to second his views, which indeed met with little favour from the public.

While Swift was thus assisting his friends, he obtained nothing for himself but empty honour, a species of reward which hardly any man ever valued less. He was too proud to make any direct solicitation; he was aware that Lord Oxford well knew what he expected, but he was not aware that he had a private and obstinate enemy in Queen Anne, who had been taught by Archbishop Sharp that the supposed author of the 'Tale of a Tub' was little, if at all, better than an infidel. He now felt that his situation was uncomfortably awkward, and began to anticipate that he might be allowed to return to Ireland neither higher in the church nor richer than he left it. He became impatient and restive. The bishopric of Hereford became vacant, and Oxford and Lady Masham, the queen's favourite, exerted themselves to obtain her consent to bestow it upon him, but the opposition of the duchess of Somerset, the queen's other favourite, whom Swift had libelled in his 'Windsor Prophecy,' frustrated their efforts. As soon as Swift knew that the bishopric had been given to another, he sent notice to Lord Oxford of his determination to retire. The ministry now saw, that unless something were done for him, they would lose his powerful aid, which had kept their enemies at bay, and had helped so effectively to keep themselves in possession of the government. Thus pressed, Oxford, with the concurrence of the duke of Ormond, proposed that Dr. Sterne should be removed to the bishopric of Dromore, in order to make room for Swift in the deanery of St. Patrick's. This they accomplished; and, with the view of retaining him in England, an effort was made by Oxford and Lady Masham to exchange the deanery for a Windsor prebend; but the queen's determination against this arrangement was not to be shaken. The warrant for the deanery of St. Patrick's was signed February 23, 1713, and early in June the same year Swift set out for Ireland to take possession.

In the early part of his Journal, Swift expresses a continual desire to return to Laracor and the society of his beloved Stella, but this feeling evidently becomes gradually weaker. The splendid society in which he moved, and the sort of homage with which he was treated, such as perhaps no other person of his rank ever received, had, long before his return to Ireland, taken strong possession of his heart; so that when he entered into the possession of his deanery, it was with feelings in the highest degree dissatisfied and desponding.

Swift was scarcely settled in his deanery when he received the most pressing invitations from the friends of the Tory administration to return to England, for the purpose of reconciling, if possible, Oxford and Bolingbroke, whose dissention endangered the very existence of the Tory government. He came over to England without delay, and soon afterwards published 'The Public Spirit of the Whigs,' a bitter attack on Steele as well as the party to which he belonged. In this pamphlet the Scotch were spoken of as 'a poor fierce northern people,' with several other offensive remarks, directed especially against the duke of Argyle. A prosecution was instituted against Barber the printer, which the ministers managed to set aside, but the Scotch peers went up in a body to complain to the queen of the indignity with which they had been treated.

Finding that Oxford and Bolingbroke could not be reconciled, Swift retired to the house of the Rev. Mr. Geary, Upper Letcombe, Berkshire, at the beginning of June, 1714. Here he wrote his 'Free Thoughts on the State of Public Affairs.' Bolingbroke was now about to supplant Oxford, and left no means untried to conciliate Swift. The queen, at Bolingbroke's earnest request, signed an order on the treasury for 1000*l*., which Swift had in vain endeavoured to obtain through Oxford, to relieve him from the debts, amounting to at least that sum, which he was obliged to incur on entering his deanery. This sum however he never received, the death of the queen having occurred before the order was presented for payment. At the same time Lady Masham wrote to him, conjuring him not to desert the queen, and Barber was commissioned by Bolingbroke to say that he would reconcile him to the duchess of Somerset. Almost the next post brought a letter from Lord Oxford, now dismissed and going alone to his seat in Herefordshire, requesting Swift to accompany him. His gratitude and his affection for Lord Oxford did not allow him to hesitate a moment in accepting the invitation of the disgraced minister, and he wrote immediately to Ireland to get an extension of his leave of absence, which was now nearly expired, to enable him to do so. Within three days the death of Queen Anne and the accession of George I. put an end to the power of the Tories. Lord Oxford was arrested and imprisoned, and Swift wrote to him with a touching earnestness to request that he might be permitted to attend him in his confinement. Lord Oxford however refused to accede to his request. Bolingbroke and Ormond fled to France, and Swift returned to Ireland.

Not long after Swift came to London to solicit the remission of the first-fruits, he was introduced to the acquaintance of Mrs. Vanhomrigh, the widow of Bartholomew Van-

homrigh, a Dutch merchant, who, at his death, had left to his widow a life interest in 16,000*l*., which sum was afterwards to be divided equally among his children, two sons and two daughters. When Swift became intimate in this family, Miss Esther Vanhomrigh, the eldest daughter, was under twenty years of age, not remarkable for beauty, but well educated, lively, graceful, spirited, and, unfortunately for Swift, with a taste for reading. He became the director of her studies, and their friendly intercourse was continued till Miss Vanhomrigh made a declaration of affection for him, and proposed marriage. How that declaration was received is related in Swift's poem of 'Cadenus and Vanessa.' Cadenus is decanus (dean) by transposal of letters, and Vanessa is the poetical name which he gave to Miss Vanhomrigh. The proposal was declined; but Swift, from vanity or fondness, or both, had not firmness enough to relinquish their affectionate intercourse.

After his return to Ireland, Swift, conscious of his imprudence, endeavoured to limit, as much as possible, the correspondence between himself and Vanessa, probably expecting that her attachment would be diminished by absence; but hers was a deep and uncontrollable passion. She wrote to him frequently, and complained bitterly of his not replying to her letters. At length Mrs. Vanhomrigh died; her two sons died soon afterwards; and the circumstances of the two sisters being somewhat embarrassed by imprudent expenses, they resolved to retire to Ireland, where their father had left a small property near Cellbridge. Swift, in his diary, though he mentions occasionally his calling at Mrs. Vanhomrigh's, makes no allusion to her daughter. Notwithstanding this caution, obscure murmurs of the intercourse between Swift and Vanessa had reached Stella soon after its commencement. In 1714 Vanessa arrived in Dublin, to the annoyance of Swift and dread of Stella. Swift saw her very seldom: he introduced Dean Winter to her, a gentleman of fortune, as a suitor for her hand; and proposals of marriage were made to her by Dr. Price, afterwards bishop of Cashel; but both offers were rejected. Stella's jealousy at length became so restless, that Swift is said to have consented to their marriage, and the ceremony was performed in 1716, in the garden of the deanery, by the bishop of Clogher; and though Swift never acknowledged the marriage, and no change took place in their intercourse, the evidence, though imperfect, is such as to leave little doubt of the fact. At length, in 1717, Vanessa and her sister retired to Marley Abbey, near Cellbridge, where Swift does not appear to have visited them till 1720, when Vanessa's sister became dangerously ill: during that illness his visits were frequent, and were continued occasionally to Vanessa after her sister's death. Vanessa by degrees became more impatient, and at length wrote to Stella, to inquire into the nature of her connection with Swift. Stella, highly indignant, sent the letter to Swift, and immediately retired to the house of Mr. Ford, near Dublin. Swift, in a paroxysm of rage, rode instantly to Marley Abbey. Vanessa, on his entering the room, was struck dumb by that awful sternness which his countenance assumed when he was in anger, and to which she more than once alludes in her letters to him. He flung the letter on the table without saying a word, instantly left the house, and rode back to Dublin. Poor Vanessa sank under the blow. In a few weeks afterwards she died, in 1723, leaving her property to Dr. Berkeley, afterwards bishop of Cloyne, and to Mr. Marshal, one of the judges of the Irish court of Common Pleas. The poem of 'Cadenus and Vanessa' was published soon after Miss Vanhomrigh's death; but Berkeley is said to have destroyed the original correspondence: a full copy however remained in the possession of Mr. Marshall, and it was published for the first time (with the exception of one or two letters) in Scott's edition of Swift's Works.

Swift, in an agony of shame and remorse, retreated to some place in the south of Ireland, where he remained two months, without the place of his abode being known. On his return to Dublin, Stella was easily persuaded to forgive him. After their reconciliation, Stella continued to be the friend of Swift, the companion of his social hours, his comforter and patient attendant in sickness; and she presided at his table on public days: but they were never alone together; their union as husband and wife was merely nominal.

In 1720 Swift published 'A Proposal for the Universal Use of Irish Manufactures.' This honestly-meant tract was represented as a seditious libel: the printer was brought to trial; the verdict of the jury was 'Not guilty;' but Judge Whitshed kept them eleven hours, and sent them back nine times, till they reluctantly left the matter in his hands by a special verdict: the public indignation however was roused, and the government, by a 'nolle prosequi,' were obliged to relinquish the contest.

In 1723, there being a scarcity of copper coin in Ireland, George I. granted to William Wood a patent right to coin farthings and halfpence to the amount of 108,000*l*. The grant was made without consulting the lord-lieutenant or privy council of Ireland: it had been obtained by the influence of the duchess of Kendall, the king's mistress, who was to have a share of the profits. It was, in fact, an infamous job. The Irish parliament expressed their dislike to it by a remonstrance, of which no notice was taken, when a voice was heard which apparently arose from one of the trading classes: a letter was published signed 'M. B., drapier (draper), Dublin,' and was followed by five or six more. The effect of these letters is known. All Ireland was roused. No one would touch the contaminated coin. A reward of 300*l*. was offered for the discovery of the author of the Drapier's fourth letter. A bill against the printer was about to be presented to the grand jury, when the Dean addressed to them 'Some seasonable Advice;' and the memorable quotation from Scripture was circulated, 'And the people said unto Saul, shall Jonathan die, who hath wrought this great salvation in Israel? God forbid: as the Lord liveth, there shall not one hair of his head fall to the ground; for he hath wrought with God this day. So the people rescued Jonathan that he died not.' The grand jury wrote 'ignoramus' on the bill, and Judge Whitshed could only vent his rage by dismissing them. Ultimately the patent was withdrawn, and Wood was compensated by a grant of 3000*l*. yearly for twelve years.

Swift's popularity was now unbounded. The Drapier's head was painted on signs, engraved on copper-plates, struck on medals, woven on pocket-handkerchiefs. As if to shelter himself from this storm of public applause, he retired with Stella and Mrs. Dingley to Quilca, a country-house belonging to Dr. Sheridan, in a retired situation about seven miles from Kells, where he remained several months. He had the company of Dr. Sheridan and other friends, and produced several light pieces of humour, in which he was emulated by Sheridan, who followed him at no great distance. He also occupied himself in revising and completing the 'Travels into several remote Nations of the World, by Lemuel Gulliver.'

In 1726 Swift visited England again, for the first time since Queen Anne's death. Bolingbroke was now returned from exile. The Dean resided at Twickenham with Pope, but made frequent visits to Dawley, the residence of Bolingbroke. His other associates were chiefly Arbuthnot, Gay, and Lord Bathurst.

At this time the Prince of Wales, afterwards George II., and the Princess of Wales, afterwards Queen Caroline, kept a sort of court at Leicester House. The favourite of the princess was Mrs. Howard, afterwards countess of Suffolk. Pope, Gay, and Arbuthnot were frequent attendants at this court. Swift was introduced to the princess by Arbuthnot, at her own particular request. His visits afterwards were frequent, especially when she resided at Richmond, but always by special invitation from the princess.

In July, 1726, the Dean received letters informing him that Stella was in a state of dangerous illness. He hastened to Ireland, and was gratified, on his arrival in Dublin, to find that her health was better. He now made the world acquainted with the 'Travels of Gulliver.' The work was published in London, anonymously as usual, through the agency of his friend Charles Ford. Such was the interest and admiration which it excited, that the price of the first edition was raised before the second could be printed.

Stella being now in a tolerably good state of health, Swift, in March, 1727, paid his last visit to London. His reception by his friends and at Leicester House was as cordial as ever. After spending the summer with Pope at Twickenham, he contemplated a voyage to France for the benefit of his health, when the death of George I. seemed to open a new prospect to the friends of the princess of Wales. It was expected that Walpole's dismissal would have taken place forthwith; and the Dean, at the earnest request of his friends, especially of Mrs. Howard, who said that his going abroad at that time would look like disaffection, remained in England.

Swift was suffering under a severe attack of deafness, which seems generally to have been more or less combined with his other and worse complaint, vertigo, when he received information that Stella was again in danger. He left England suddenly, almost capriciously as it appeared to his friends, who had but an indistinct notion of his connection with Stella, and in October, 1727, landed in Dublin to find his companion on the brink of the grave. She died Jan. 28, 1728.

When Swift had somewhat recovered from this last and severest shock, he found Walpole still in power, and high in favour with the queen as well as the king. He now kept no terms with the court; he attacked Walpole especially, and the ministry generally, and did not spare even the king and queen. At the same time he applied himself vigorously to the affairs of Ireland: he published several tracts for the amelioration of the unhappy state of that country; and, with the same object in view, commenced a periodical publication, in conjunction with Dr. Sheridan, called 'The Intelligencer,' which however was soon dropped.

In 1728-9 the Dean spent about a year with Sir Arthur Acheson, at his seat of Gosford, in the north of Ireland; here he wrote several light pieces of poetry, which were intended for the amusement of the family and guests; among these was 'The Grand Question debated, whether Hamilton's Bawn should be turned into a Malthouse or a Barracks,' affording evidence that age had not in the least impaired those peculiar powers of humour which he had first displayed in the family of Lord Berkeley. In 1730 the Dean was a guest for six months in the house of Mr. Leslie at Market Hill, a small town at a short distance from Sir Arthur Acheson's. Near this town he intended to build a house, on ground to be leased from Sir Arthur, and which was to have been called Drapier's Hill; an intention however which he did not carry into effect.

In a satire upon the Dissenters, in 1733, the Dean had directed a few lines against 'the booby Betteswortb,' who was a serjeant-at-law and a member of the Irish parliament, and who, on reading the lines was so highly incensed that he drew a knife, and swore he would cut off the Dean's ears; he proceeded direct to the deanery with that intention, but as Swift was on a visit at Mr. Worrall's, Bettesworth went there, and requested to speak with the Dean alone, whom he addressed with great pomposity, 'Dr. Jonathan Swift, Dean of St. Patrick's, I am Serjeant Bettesworth.' 'Of what regiment?' asked Swift. An altercation ensued, which soon became so loud and violent, that the servants rushed into the room and turned Bettesworth into the street. To guard against any similar attack in future, the Dean's neighbours formed an association, for the purpose of watching the deanery and guarding the person of the Dean from violence.

In the year 1735 he supported the clergy in their claim of the tithe of pasturage, or agistment tithe, in opposition to the Irish House of Commons, and gave vent to his indignation against the obnoxious members in one of the last but most animated and pointed of his satires, 'The Legion Club.' The poem was hardly finished when he had one of the most intense and long-continued attacks of vertigo which he had ever suffered, and from which indeed he never thoroughly recovered.

In 1736 Swift opposed the primate Boulter's scheme for regulating the exchange with Ireland by diminishing the value of the gold coin in order to increase the quantity of silver: he spoke against it in public; he wrote ballads against it; and on the day when the proclamation of the government for carrying the measure into effect was read, the bells of the cathedral rang a muffled peal, and a black flag was seen to wave on the steeple.

Swift's public life may now be said to have closed. From 1708 to 1736 he had been actively, strenuously, and often dangerously busied in guiding by his pen the course of public affairs; but during the latter part of this period his infirmities and sufferings rapidly increased. In 1732 Bolingbroke had attempted to bring him to England by negotiating an exchange of his deanery for the living of Burfield in Berkshire, worth about 400*l.*, but it was too late; the sacrifice of dignity and income was greater than, at that period of his life, he was willing to submit to. He still continued to correspond with Bolingbroke, Pope, Gay, the Duchess of Queensberry, and Lady Betty Germain, by all of whom he was constantly pressed to come over to England; but as his attacks of deafness and giddiness became more frequent, more violent, and continued longer, he did not think it prudent to venture. Gay died in 1732, and Arbuthnot in 1734, and Bolingbroke went to France. With Pope he kept up an affectionate correspondence as long as he retained the power of expressing his thoughts upon paper. For several years before his mind gave way, he was hardly ever free from suffering, and never from the fear of it; and it was his custom to pray every morning that he might not live another day, and often when he parted at night with those friends who were dearest to him, after social hours spent at the deanery, he would say with a sigh, 'I hope I shall never see you again.'

In the intervals of his fits of giddiness his powers of judgment remained unimpaired, but his memory failed rapidly. On the 26th of July, 1740, in a short note to Mrs. Whiteway, he says—'I have been very miserable all night, and to-day extremely deaf and full of pain. I cannot express the mortification I am under of body and mind. All I can say is, that I am not in torture, but I daily and hourly expect it. Pray let me know how your health is, and your family. I hardly understand one word I write. I am sure my days will be very few; few and miserable they must be. I am, for those few days, yours entirely, J. Swift. If I do not blunder, it is Saturday.''

In 1741 Swift's memory had almost failed, his understanding was much impaired, and he became subject to violent fits of passion, which soon terminated in furious lunacy. He was intrusted to the care of the Rev. Dr. Lyons, who was gratefully attached to him. He continued in this state till 1742, when, after a week of indescribable bodily suffering, he sank into a state of quiet idiotcy, in which he continued till the 19th of October, 1745, when he died as gently as if he had only fallen asleep. He was in his 78th year. The immediate cause of death, and probably of the giddiness which had so long afflicted him, was found to be water on the brain.

On the announcement of his death, the enthusiasm of Irish gratitude broke out as if there had been no interruption of his public services. The house was surrounded by a mournful crowd, who begged the most trifling article that had belonged to him to be treasured as a relic—'yea, begg'd a hair of him for memory.' He was buried, according to his own direction, in the great aisle of the cathedral, where there is a Latin inscription to his memory, written by himself:—'Hic depositum est corpus Jonathan Swift, S.T.P., hujus Ecclesiæ Cathedralis Decani, ubi sæva indignatio ulterius cor lacerare nequit. Abi, viator, et imitare, si poteris, strenuum pro virili libertatis vindicem. Obiit,' &c.

Swift left the bulk of his property, the savings of about thirty years of his life, to found and endow an hospital for lunatics and idiots. In 1735 he presented a memorial to the corporation of Dublin, praying that a piece of ground on Oxmantown Green might be assigned for the purpose, which was immediately assented to, but the site which he ultimately fixed on was in James Street, Dublin, near Stevens's Hospital. The funds which finally devolved upon the hospital amounted to about 10,000*l.*

For some years before his intellect failed, the general superintendence of the Dean's domestic affairs had been intrusted by him to Mrs. Whiteway, who was a daughter of his uncle Adam: she was a woman of property, of superior understanding, and elegant manners. She was not his housekeeper, as has been erroneously stated. His housekeeper was Mrs. Brent, who by a second marriage became Mrs. Ridgeway.

Swift in his youth was considered handsome: he was tall, muscular, and well-made; his complexion was dark, and his look heavy, but Pope says that his 'eyes, which were azure as the heavens, had an expression of peculiar acuteness.' His face was generally expressive of the stern decision of his character. He never laughed, and seldom smiled, and when he did smile it was

> 'As if he mock'd himself, and scorn'd his spirit,
> That could be moved to smile at anything.'

In his person he was scrupulously clean; in his habits he was regular; he was a strict economist of time and money, and kept minute accounts of the expenditure of both; he used much exercise, both walking and riding; he drank wine daily, but never to excess; in eating he appears to have been somewhat of an epicure. In his disposition he was social; and when his company pleased him his conversation was delightful, abounding in anecdote, and rather distinguished for liveliness and humour than for seriousness. In repartee he was considered unrivalled. He had peculiarities

of manner, which however were not constant and habitual, but generally arose from the indulgence of some occasional whim. From the time of his admission into Trinity College he had mixed much in society, generally of the best kind: he was an observer of society of a lower kind, but he never willingly mixed with it. He spoke in public with force and fluency.

The distinguishing feature of his character was pride—a complete consciousness and appreciation of the value of the power which he had acquired by a severe course of study and observation, combined as it was with a determination of purpose which no danger could intimidate, and which turned aside from no labour necessary to the accomplishment of his aims. He was thoroughly honest, but his honesty was often combined with a straightforward bluntness which was offensive to fastidiousness and vanity. In spite of the sternness of his character, which was often indeed more in appearance than reality, he was a man of deep feeling, devotedly attached to his friends, and active in promoting their interests; nor were his friends less attached to him.

There was much appearance of paradox in Swift's character, which often arose from his assuming, in speaking and writing, a character which did not belong to him. He hated hypocrisy, he hated the assumption of virtue, and he ran into the opposite extreme. Thus the levity of manner with which he censured the corruptions of Christianity induced many to suppose that he was not a Christian; and the tone of misanthropy which pervades many of his writings was ill suited to the real character of one who annually expended a third part of his income in well-directed charity; who, of the first 500*l.* which he had to spare, formed a loan-fund for the use, without interest, of poor tradesmen and others; who was a warm and steady friend, a liberal patron, and a kind master. He who always spoke of Ireland as a country hateful to him, was yet the firm, fearless, and constant assertor of her rights and protector of her liberties. Johnson speaks of his love of a shilling. Habits of strict economy have given many a man the appearance of loving a shilling who thinks nothing of giving away pounds. We have spoken of the use which he made of his money: in the obtaining of it he was no less free from sordidness. Of the numerous works which he published, most of which were extremely popular, it is doubtful if he ever received for any one a single shilling of direct remuneration. Pope obtained something for Swift's share of the 'Miscellanies,' but there is reason to suspect that he directed his friend, who did love a shilling, to keep the sum for his trouble.

Swift's conduct towards Stella and Vanessa is that part of his character of which least can be said by way of justification. We have given the details of that conduct briefly, and leave the reader to draw his own conclusions.

In his political principles he was rather a Whig than a Tory, but party, as a distinction which prevents the intercourse of individuals, he regarded with dislike and scorn. He approved of triennial parliaments, nay annual parliaments; he was the defender of popular rights, and frequently exposed himself to danger in defending them; he was a steady advocate of constitutional freedom. His hatred of tyranny was almost a passion. The oppression which he saw practised in Ireland was one chief cause of his dislike to living in that country. He was vexed to see the tame submission with which the Irish yielded to the tyranny of their rulers. He always spoke of his residence in Ireland as an exile, and, with intense bitterness of feeling, of himself as one condemned to die there 'like a poisoned rat in a hole.' The separation from his friends in England certainly contributed to produce this feeling.

In his religious principles he was a violent high-church bigot. He would admit of no toleration either of Roman Catholics or of Dissenters as a body, and Jews he classed with infidels. But he did not extend these intolerant principles to individuals. Probably he did not know that Bolingbroke was an infidel, but he did know that Pope was a Roman Catholic.

Swift's acquaintance with the Greek and Latin writers was extensive, but not profound. French he wrote and spoke with facility, and he understood Italian. He was well read in Chaucer and Milton, but never mentions Shakspere, and does not appear to have had a copy of his works. His acquaintance with English prose writers was chiefly among the historians, especially Clarendon.

Swift, almost beyond any other writer, is distinguished for originality. He was an observer for himself, and was disdainful of obligation for anything but such facts as were not within his reach. His modes of combining and comparing those facts, whether ludicrous or serious, were always his own.

As a prose writer, his style is distinguished by plainness, simplicity, and perspicuity; it is sometimes ungrammatical and often heavy, but is occasionally forcible and pointed. As to his numerous political tracts, when they had accomplished the end for which they were written, he cared no more about them; and most readers now care as little. He could hardly be said to be at all ambitious of the reputation of an author. His object in writing was to produce an effect upon the public, or to please his friends. The object once attained, he thought no more about the means by which it had been accomplished. His letters, of which a great number have been published, are excellent specimens of that species of composition: written, without any view to publication, either to keep up the intercourse of friendship or for purposes of business, they abound in practical good sense, clear, unaffected, unembellished, with occasional touches of wit and humour, such as appear to have arisen, without being sought for, in the writer's mind at the moment of writing. A few of his Sermons have been published; they are of the most plain and practical character.

As a party-writer, he used no arms but such as are considered fair in that species of warfare. He was not one of those who make false statements; he was no assailant of virtuous character. The vices and the faults of those public men to whom he was opposed were censured with unsparing severity, or covered with ridicule; but the men were such as Wharton and Wood and Bettesworth. Men of less objectionable character were touched more lightly.

Swift's permanent reputation as a prose writer is likely to depend, to a considerable extent, upon his humorous pieces, but chiefly upon his 'Gulliver's Travels.' For this satirical romance he derived hints from Lucian, Bergerac, and Rabelais; but he derived nothing more than hints. His claim to originality is unaffected by any resemblance which his romance bears to these sources. The style of the work is an admirable imitation of the plain, dry, and minute style of the old voyagers, such as Dampier; and the character of Gulliver himself, as a representative of this class, is never for a moment lost sight of. The work consists of four voyages. The Voyage to Lilliput is for the most part a satire on the manners and usages of the court of George I. The Voyage to Brobdignag is a more extended satire on the politics of Europe generally. These two voyages are indisputably the most delightful parts of the book; and are read by most readers with great pleasure as mere tales, with such admirable skill is an air of truth and reality thrown over the narrative. The Flying Island is a satire directed against speculative philosophy, especially mathematics. For this part of his task Swift was but poorly qualified, and, except that part which is aimed at projectors and quacks, the satire for the most part falls harmless. The fourth voyage, in which Gulliver gets among the Houyhnhnms and Yahoos, is an exaggerated satire on the vices of mankind. The fiction is in itself unnaturally impossible, and the details are sometimes disgustingly filthy.

Swift's poems are not, properly speaking, poetry, nor is Swift a poet; his imagination is not of the kind which produces poetry; it is not filled with the beauty and magnificence of nature, but with the petty details of artificial life; he is a satirist of the first class; as a poetical describer of manners, he has never been excelled; as a poetical humorist he almost stands alone; indeed the most delightful of his poems are those in which he expresses the notions and uses the language of some assumed character, as in 'Mrs. Harris's Petition.' In this species of humour he had no model, and, with the exception of Thomas Hood, no imitator has ever approached him. Of the general style of his poems, Dr. Johnson remarks that 'the diction is correct, the numbers are smooth, and the rhymes exact. There seldom occurs a hard-laboured expression or a redundant epithet. All his verses exemplify his own definition of a good style—they consist of proper words in proper places.'

(Scott's *Life and Works of Swift*, 19 vols. 8vo.; Sheridan's *Life of Swift*; Johnson's *Life of Swift*; Orrery's *Remarks on Swift*.)

SWIFT, DEANE, was the grandson of Godwin Swift, the eldest of the uncles of the dean of St. Patrick's. The Christian name of Deane was derived from his grandmother, daughter and heiress of Admiral Deane, who served the Commonwealth during the civil wars. He studied at

Trinity College, Dublin, and afterwards resided at Goodrich in Herefordshire. He married a daughter of Mrs. Whiteway by her first husband, the Rev. T. Harrison. Deane Swift wrote an 'Essay upon the Life, Character, and Writings of Dr. Jonathan Swift; interspersed with some occasional Animadversions upon the Remarks of a late critical Author, and upon the Observations of an anonymous Writer on these Remarks; to which is added that Sketch of Dr. Swift's Life, written by the Dr. himself, which was lately presented by the Author of this Essay to the University of Dublin,' Lond., 1755, 8vo. He also published 'The Works of Dr. Jonathan Swift, Dean of St. Patrick's, collected and revised by Deane Swift, Esq., of Goodrich in Herefordshire,' London, 1765, 12mo., about 20 vols. Deane Swift contributed a portion of correspondence to Nichols's edition of Swift's Works, 19 vols. 8vo. He died at Worcester, July 12, 1783.

SWIFT, THEOPHILUS, was the son of Deane Swift, and was born at Goodrich in Herefordshire. He wrote 'The Gamblers,' a poem, 4to.; 'The Temple of Folly,' in 4 cantos, Lond., 1787; 'Poetical Addresses to his Majesty,' 1788, 4to.; 'Letter to the King on the Conduct of Colonel Lennox,' 1789, 4to. His remarks in this letter gave offence to Colonel Lennox, who demanded satisfaction, and a duel was the consequence, in which Swift received a pistol wound. In the year 1790 a man lurked at night in the streets of London, and wounded females with a sharp instrument. He escaped detection for some time, and the public called him 'The Monster.' A person of the name of Williams, an artificial-flower maker, was at length arrested, tried, found guilty, and sentenced to six months' imprisonment. Theophilus Swift seems to have thought that this man was innocent, and exerted himself, both at the trial and afterwards, to prove his innocence. He wrote a 'Vindication of Renwick Williams, commonly called the Monster,' Lond., 1790. Theophilus Swift wrote an 'Essay on the Rise and Progress of Rhyme,' which was printed in the 'Transactions' of the Irish Academy, vol. ix., 1801; and in 1811 he published at Dublin 'Mr. Swift's Correspondence with the Rev. Mr. Dobbin and his Family.' Scott's edition of Swift's Works contains several communications from Theophilus Swift. He inherited from his grandmother, Mrs. Whiteway, a considerable estate in the county of Limerick. He died in Ireland, in the summer of 1815.

(Scott's edition of Swift's *Works*; Watt's *Bibliotheca*, &c.)

SWIMMING. Huet, bishop of Avranches, in his 'Mémoires,' vol. i., p. 50, relates the following anecdote of himself:—'Being accustomed, like other boys, to bathe several times a day in the hot weather, it happened that I ventured into a stream without first trying its depth, and immediately sunk to the bottom: but being roused to the utmost exertion by the urgency of the danger, I struggled so hard with my hands and feet as to raise myself to the surface of the water; and having thus discovered that I possessed a faculty with which I was before unacquainted, I swam across a deep river on that very day.' The above passage is quoted by Bucke, in his 'Book of Human Character' (vol. ii., p. 279), with this additional remark:—'How many thousand men have been drowned in all parts of the world! Nine in ten of these might doubtless have been saved had they possessed the force of character here described; and the remark may be extended to many of the general affairs of life, since many of them depend on nothing more than the will.' This is no doubt very true, not only in the individual instance, but in other instances of swimming; as a principle however it must be regarded as most delusive and dangerous. For inasmuch as nine individuals out of ten do not possess the force of character described of bishop Huet, so will nine out of ten continue to be drowned if they get beyond their depth in the water without any previous knowledge of the art of swimming.

In London at this present time there are not above eight swimming-baths. Regular swimming-schools are established in Vienna, Münich, Breslau, Berlin, and Paris. But the English are not much inclined to swimming, even when the means are at hand. Probably not one in ten of all our sailors, both in the navy and merchant service, can swim. When a ship is wrecked within a hundred fathoms of the shore, and no boats or other assistance arrive, it is melancholy to observe how few even attempt to swim ashore, and those very few who do so are usually passengers. Familiarity with the element makes our sailors indifferent to it, and careless of consequences. Among the inhabitants of the metropolis those who can swim have acquired the art at watering-places, or at the Serpentine River in the summer season, instigated solely by the novelty and amusement. Very few in comparison attend the public baths, chiefly perhaps because they are not gratuitous.

Art of Swimming.—It is in the power of everybody to swim who possesses a moderate degree of health and activity. But all will not swim equally well, even with the same amount of practice. Some will learn quickly, others slowly, and some will always swim with far less effort than others. The quickness of acquirement depends upon natural aptitude and a correct method; the necessary degree of effort, after acquiring the art, depends upon the natural buoyancy of the individual's body, in which respect there are sometimes great differences. A very thin man of large bone may be a powerful swimmer for a short distance, but could not well relieve his efforts by floating, because floating would require continued efforts with a body so constituted. Those bodies which are best adapted to become fine swimmers are such as have a tendency to fatness with a good muscular development: they cover more surface. A very large and heavy head, very small hands and feet, and a very weak wrist, are all attended with proportionate difficulties. But any one who is tolerably healthy and active may in time become a very good swimmer, in spite of all physical difficulties. The only exception would be where an individual had lost a leg, in which case he could probably do little beyond floating, and rowing with his arms for some hundred fathoms; but a man who had only lost an arm might swim a very long way.

Method.—The only school for learning to swim is that of deep water; the only correct master is the frog. Man can never be more than an humble imitator of the frog, because the short, broad, buoyant body, broad webbed feet, light, flat, angular head, and (comparatively) immense length and strength of the legs (hind legs), give him physical advantages which set all human competition at defiance. We can never expect to dart forward by a few strokes like the frog, but the method by which he does so is the only correct one for our acquiring the art of swimming. It is always to be borne in mind by the learner that the stroke which is to sustain and propel him must be compound, that is, the action of arms and legs simultaneously. It is observable that learners always waste their strength in wild struggles of the arms and legs alternately, in doing which they make a great splashing, kick their heels up behind, get their mouths full of water, and go down. Learners will often continue to act in this way during a whole summer season, though they bathe several times a week; indeed they will, in many instances, make no better progress for years. It is by the stroke made with the arms and legs at the same instant that the body is sustained and propelled. This stroke must not be made on the surface of the water, nor must the individual kick up his heels in the air behind him; the sweep of the arms and spurn of the legs must always be made under the water, and rather deeply so with the legs. It is advisable not to swim too straight and horizontal upon the water, as it will soon occasion pain in the back of the neck. The back should be kept hollow, slanting, and steady, never rising with the stroke, except as the whole body rises. The hands must on all occasions be kept in the shape of a cup or scoop, the fingers and thumb so close that the hands would hold water, as when people drink from a brook. The same closeness and hollowness should be preserved in the toes and shape of the feet, the toes being bent downwards or crooked. In making the stroke the palms of the hands are placed together and pushed straight forwards, like the keel of a boat's bows, about an inch under the water; at the same moment the knees are drawn up beneath the body, and widely. This is the first preparatory motion for making the stroke; it is in fact crouching, or rather a sort of squatting, to take your spring. The next motion is that of the hands, shaped like a scoop, with the thumb downwards, and sweeping back the water from you, with a wide sweep, like that of an oar, bringing the whole of the arm manfully into action from the shoulder; but at the same moment that this is done, the legs are thrown back, the feet vigorously pushing back the water beneath you, your entire effort of mind and body being that of making a spring forward. The hands are to be swept out as far as you can, and the effort to be relaxed only when both hands have been swept as far beyond a horizontal extension as you can effect without straining your shoulders and blade-bones.

This motion of the arm and hands having been made, the action is instantly relaxed, the arms are bent, with the elbows drawn back till the ball of the thumb of each hand gently touches the ribs on both sides; and the hands being then again brought palm to palm together, are sent forward in a direct line (the tips of the two thumbs passing exactly under the centre of the chin) to repeat the stroke. In like manner, the motion of the legs and feet having been made, the action is instantly relaxed, and the legs are extended out straight, with the toes pointing gently downwards, till the knees are again drawn up, to repeat the stroke. The learner should understand that the principal propelling power is in the legs; the arms and hands he should chiefly consider as the means of sustaining his head above the surface. The power of propelling, as well as sustaining, by the action of the arms and hands, he will discover as he acquires proficiency. But as it is important to acquire the best method at the outset, so as to ensure the foundation of a good habit, he should make the sweep of the arms and hands describe as wide a semicircle as he can, while the extent of water acted upon by the legs is of still greater importance. At the moment when the hands pressed together are passing under the centre of the chin, the knees should be drawn up, by no means close under you, but as widely as you can, and with the heels as far apart as you can extend them without straining yourself, the toes being contracted (so as to render the sole concave) and turned outwards. This wide extension is most important, and one of the chief distinctions between a fine swimmer and others, because it is the object of the former to get as large a wedge of water between his legs as possible, so that when he spurns back the water with the hollowed soles of his feet, he may at the same time bring the whole inside surface of his legs to bear upon this wedge in the act of bringing his heels together. The propelling power of the soles of the feet is a trifle in comparison with that which is to be obtained by the creation of this wedge. The greatest amount of force is to be obtained from the inside and under part of the thighs; and this is one reason why thin men are not so well adapted to become fine swimmers as those whose limbs present a larger surface to act upon the water.

Confidence.—The use of corks, bladders, or life-preservers is certain to retard, if it does not almost destroy, the learner's confidence in the natural buoyancy of his body in the water. They are also bad supporters for those who wish to learn the real consequence of any particular action of a limb or motion of a part of the body in the water, because they cause you to bob about; and not only prevent you from doing what you intended, but often make you do the contrary. They teach you not to rely upon yourself, and should be regarded as opponents to the art of swimming. They are moreover very dangerous; for should they slip from their fastenings at the shoulders or round the waist, and entangle themselves round your feet, you will assuredly be drowned, unless somebody is at hand to extricate you. A good swimmer would have the greatest difficulty in saving himself if placed in such a predicament, not because his legs were fastened together, but from the disproportionate buoyancy thus given to his heels. He could not lie on his back and float for any length of time, as the weight of his head, in this case, would require continual efforts for its support; so that his only chance, if not assisted, would be that of suffering his head to be immersed while he employed all his efforts to tear off these disastrous supporters. The life-preserver is in itself a noble invention, but was never intended to be used by those who are learning to swim; for if you make use of the life-preserver, bladders, or corks, it is these which float, not you who swim. Entire confidence in the water is of course only to be obtained by acquiring such a proficiency in swimming as shall induce the feeling of a mastery over the element: a considerable degree of confidence however may be acquired from repeating a very simple experiment. Choose a spot for bathing where the bank is gently sloping, and wade in it till the water is breast-high. It is of no use unless the water is at least breast-high. Then turn round and face the shore or bank, and as the learner will thus be aware that his efforts are tending in a safe direction, he may plunge forwards and downwards without fear. The object of this experiment is to dive to the bottom and bring up some gravel, or a stone if the water be clear enough to see one. So far from sinking to the bottom in anything like a horizontal position of body being an easy matter, the learner will immediately discover that it is very difficult to get to the bottom with his hands, and bring up the gravel or stone. Another method of ascertaining the natural buoyancy of the body, and how little it really requires to sustain it on the surface of the water, is to take a couple of common boat-oars, place one under the back of the neck horizontally, and lifting up first one heel, then the other, place them across the other oar, extending the body stiffly at the same time. If you bend the body at all, as in a sitting posture, you will instantly sink; but so long as the body be kept straight, with the chest elevated, you cannot sink, and may lie there as long as you like. It is also a good plan, of a similar kind, to let a friend place one hand under the back of the head of a learner, who should then sink gently backwards upon the water, with his chest elevated and his legs extended straight, and he will find how very little he needs to support him. It is always to be borne in mind, however, that nobody can readily learn to swim who has a great antipathy to his head being frequently immersed, an occurrence quite unavoidable at first, and which must be considered as of no sort of consequence The only real objection to it (for a few mouthfuls of water now and then can hurt no one who is in good health) is when it occasions the headache, as it does to rather a painful degree with some individuals when they have attained the age of manhood. For this reason, among many others, swimming should be learned in early youth.

Deep Water.—It is by no means advisable that a learner should enter any piece of water which is everywhere out of his depth, or contains unknown holes which are so; indeed it would be best not even to bathe where there is a shelving bank leading to water beyond the learner's depth, without a companion who can swim well. At the same time, it is of no use to attempt to learn in shallow water. All practice in shallow water is nearly certain to be futile, as it induces a foolish habit of self-deception. Youths will very often continue for two or three years to flatter themselves that they can swim, although they are accustomed every now and then to drop one leg, and touch the bottom with their toes. If they have accidentally got into deeper water, so as to be unable to do this, they instantly feel themselves in danger of being drowned, and splash and scramble back again in manifest alarm. The best depth for a learner is that of breast-high; but the water should not rise above the chest, or he will be unable to walk, or, perhaps, keep his feet. Should he, after making a few efforts to swim, accidentally get into water which rises as high as his chin, he must not hastily attempt to walk back; for no sooner would he lift one leg than the water would take the other from under him, which might confuse him: he must either plunge forwards boldly towards the less deep part of the water, slowly slide his feet along the bottom, or else dance his way out in slow and mincing steps, carefully keeping his arms and hands under the water to steady himself. No learner should enter the water without a companion who can swim well, or at all events is taller and stronger than himself.

General Pfuel's Method.—The method of teaching swimming, which was first introduced in the swimming-schools of Prussia, by General Pfuel, is, in all respects, excellent, and may be briefly described. The teacher stands on a platform on the edge of the water (the level borders of a river would be just as good) behind a strong oak rail, running horizontally to the extent of twenty or thirty feet, and about four feet high from the level of the platform or bank. The teacher holds a staff of about nine feet in length, to the top of which a rope is attached, which descends towards the water and is inserted in the ring of a belt, which belt is fixed under the arms of the learner, who lies along the water. The wooden rail thus becomes the fulcrum, and the staff a lever. It is managed with ease by one hand of the teacher, as the staff rests upon the rail, and also has the other end upon the ground. The learner is supported by the rope, which rises from the ring between his shoulders. He lies straight along the water, the arms being extended forwards, with the hands placed together, and the legs stretched out, with the heels touching each other, and the feet turned outwards, though the toes are crooked in. The teacher begins with the action of the legs. He says 'One!' and the pupil draws up his legs, keeping the knees as far apart as he easily can. The word 'Two!' is then given, and the pupil makes the stroke with both legs, striking out his legs so that the heels shall describe as large an angle as possible. At the word

'Three!' he resumes his original position. When he can effect the motion properly in three divisions, he has to perform the same in two; but if he fail to extend his legs wide enough, he is again called upon to do the last two motions separately (as two and three), until he can give the wide stroke efficiently before returning to the first position. While the motion of the legs is being practised, the pupil must keep his arms extended forward in the water, and not allow them to sink. The motion of the hands is next taught in two divisions. The teacher says 'One!' and the pupil's hands, which were extended with the palms placed together, are separated, and laid about two inches under water, with the palms downwards, and the arms are extended until they form an angle of 90 degrees, or more, if it does not strain the back: the elbows are now bent, and the thumbs of the hands are brought under the chin. 'Two!' is the signal for stretching the hands forward to regain the first position. It is important to make the motions slowly at first, in order to secure the utmost width of stroke. When the motions of the hands and legs are properly performed separately, they are then united, and at the word 'One!' the first motion of the hands and legs is performed; at the word 'Two!' the second and third motions of the legs, and the second of the arms, are made. When the learner begins to be able to support himself, the teacher raises the lower part of his staff (resting against the rail), which thus lowers the top, and therefore slackens the rope; but instantly brings the staff into a more perpendicular position if he sees the pupil sinking. When he can swim ten strokes in succession, the staff is abandoned, and the master only holds the rope; when he can swim forty or fifty strokes, the rope is taken away, but the teacher always keeps near enough to reach him with a long pole. The pupil is not considered safe until he is able to swim for half an hour without resting or receiving assistance.

Turning in the Water.—The learner should regard his hands as two fins, and his feet as a double rudder, or (when his heels are close and his feet turned out) as a fish's tail. To give minute directions for the various positions of the hands would perhaps only confuse: it will be better to confine the remarks to a few general principles, and to making him aware of the means he possesses, the application of which he can only ascertain by practice in the water. He who can swim forwards, and would turn to the right or to the left, has merely to turn his head in the direction he would go, and narrow the sweep of the arm on that side to which he would turn, or back water with the hand on that side if he would turn rapidly. Nature will second his efforts far more efficiently than he expects. In like manner, if he would turn back, he has only to turn the palm of one hand outwards, and strike the water from him (which is nothing more than backing water with an oar), while his other arm sweeps inwards, as if embracing the water or taking an armfull of it towards his side, and round he goes in two or three motions. The legs will act as they ought of their own accord; but the act of turning back will be more rapidly effected if the legs be dropped, and the feet strike downwards: in short, if the position of the body be nearly perpendicular, as it will thus present so much less surface for resistance.

To Swim on the Back.—Sink backwards very softly on the water, inflating and elevating the chest at the same time, keeping the back hollow, and the head thrown back so that the eyes look up at the sky. The arms and hands should work under the water like oars, while the legs are drawn up and struck down into the water, both legs and both arms acting together. The action of the arms is not necessary for swimming on the back, except in learning, and they should be rested with the hands placed upon the thighs as soon as the learner can afford to dispense with the use of them. The causes of difficulty in acquiring this mode of swimming may, in nearly all cases, be reduced to two: the dropping of one leg towards the bottom in order to assist (as the learner intends) his support and progress by a jerk from the ground; and the bending of the body instead of keeping it quite straight, which bending is usually accompanied by raising the head with intent to look at the legs, in any of which processes the learner is certain to sink immediately.

To Float.—Having learned to swim on the back, it will not be difficult to acquire the art of floating. The chief principle is that of taking the right position. The learner should lie backwards very softly and very straight, the back hollowed, the chest elevated and inflated, and the head thrown well back till the water encircles the face. It is always to be recollected, be the water as deep as it may, that so long as the mouth, nose, and eyes are not immersed, the human body safely floats. The legs should remain perfectly straight and quiet; the palms of the hands should be turned downwards and gently beat down the water like fins. If the body begin to reel over on one side, the palm of the hand on this side has only to be turned outwards, and one or two gentle motions will restore the equilibrium.

Cautions.—The learner should avoid the practice of all ingenious antics and manœuvres, however curious and amusing, until he can swim well in the ordinary way, both on his belly and his back, and is able to rest himself by quiet floating. The practice of manœuvres, if successful, is certain to give young swimmers a false security, and should never be indulged in till they can accomplish the distance of at least a quarter of a mile without touching ground or receiving any other support. Never leap or plunge from a height without having first accomplished it by degrees of a foot at a time. One failure of the proper position and method will constitute a lesson of caution beyond the power of words to convey. Never remain long in the water upon an empty stomach, nor enter it immediately after a full meal. Never enter the water in a state of perspiration, nor when very cold, especially if recently heated. If you are subject to the cramp, never bathe out of the reach of assistance. When you rise after being immersed, breathe first out from the nostrils (to expel the water) before you take in your breath at the mouth. Avoid water which contains cold springs or beds of weeds. Whenever you attempt to save the life of a drowning person, be sure not to let him lay hold of you. Take a stick, if you can, and present one end to him. If you have no stick, approach him very cautiously from behind, and wait till you can firmly seize him with your left hand by the upper part of his right arm, and then keep at arm's length. If you cannot manage him your own way, dive and make your escape, or both will be lost. Return when he has become insensible.

SWINBURNE, HENRY, an English traveller, was born in May, 1752. He was the third son of Sir John Swinburne, Bart., of Capheaton, in the county of Northumberland, of an antient Roman Catholic family. He received his education at the monastic seminary of Lacelle, in France, where he made rapid progress in the study of antient and modern literature and in drawing. By the death of his eldest brother, he became possessed of an annuity and of a small estate at Hamsterley, in the county of Durham, and was thus placed in independent circumstances. He now set out on a tour, in which he visited Turin, Genoa, Florence, and other parts of Italy, improving himself on his route in the knowledge of works of art and in drawing. On his way home through Paris, he became acquainted with and married Miss Baker, daughter of the then solicitor-general of the West Indies, and, returning to England, resided with her some time at his estate at Hamsterley, where he amused himself with gardening and laying out grounds. He soon recommenced travelling, and reached Paris in March, 1774; in the autumn of the same year he proceeded to Bordeaux, and, after spending a year in the south of France, accompanied his friend Sir Thomas Gascoigne on a tour in Spain: they travelled along the coast from Barcelona to Cadiz, and thence through the interior to Madrid, Burgos, and Bayonne, where they arrived in June, 1776. At the close of this year Swinburne, in company with his wife, left Marseille for Naples. He remained in Italy till June, 1779, during which period, after staying a year at Naples, at the court of Ferdinand IV., he visited Sicily, Rome, Florence, and Turin, whence he returned to France. About this time he published an account of his Spanish tour in a series of letters, and spent the latter part of the year 1779 in England. The next year he travelled through France and Italy to Vienna, where he was received with much kindness by the empress Maria Theresa and her son Joseph II. He was again in England in 1781, and in 1783 set out for Paris to seek indemnity from the French government for the loss of his West India property, which had been devastated during the war. Through the favour of Marie Antoinette, he obtained in compensation a grant of land in the island of St. Vincent, the value of which was however much reduced on the cession of this island to Great Britain. In 1786 Swinburne again went to Paris, and returned in 1788.

After having long solicited a diplomatic appointment from the British government, he was appointed, in 1796, commissioner for the adjustment of the cartel then proposed for the exchange of prisoners-of-war between France and England. In the performance of this service great difficulties occurred from the refusal of the French to give up Sir Sidney Smith; and, after long and fruitless negotiations, Swinburne was finally recalled at the close of the year 1797. His latter years were saddened by the loss of his son, who was shipwrecked on his way to Jamaica, and by the diminution of his fortune, which induced him, in 1801, to accept the offices of vendue master in the island of Trinidad, and commissioner for the restoration of the Danish islands. After a few months' residence at Trinidad, Swinburne fell a victim to the climate, April 1, 1803.

His works are—'Travels through Spain in the Years 1775 and 1776,' London, 8vo., in a series of letters; 'Travels in the Two Sicilies in the Years 1777, 1778, 1779, and 1780;' and a Correspondence extending from the year 1774 to that of his death, edited by Charles White, Esq., under the title of the 'Courts of Europe at the close of the Last Century,' 2 vols. 8vo., London, 1841. This publication contains many curious details concerning the courts of Louis XV. and Louis XVI., and the most stirring periods of the French Revolution. Swinburne is a lively and sensible writer; he describes everything in an easy, unaffected, and sometimes forcible style; he is an attentive observer of national characteristics, and has selected with judgment such anecdotes and incidents as best illustrate the manners of different countries.

For his Life see a short notice in Nichols's *Literary Anecdotes*, vol. ix.; the Introduction to his *Courts of Europe*; and his Letters generally.

SWINDON. [WILTSHIRE.]

SWINE. [HOG; SUIDÆ.]

SWINEMÜNDE is a small but important town in the government of Stettin, in the kingdom of Prussia, in 53° 50′ N. lat. and 14° 12′ E. long. It is situated in the island of Usedom, at the mouth of the river Swine, which here falls into the Baltic. All ships to and from Stettin pass Swinemünde, and, till of late years, the entrance was obstructed by a bar, so that ships drawing more than seven feet water could not pass it; and large vessels were obliged to discharge part of their cargoes into lighters before they could proceed to Stettin; and those which were going to sea had to complete their cargoes after crossing the bar. To remedy this inconvenience, which was more and more felt as the trade of Stettin increased, it was resolved to construct two great moles, and thoroughly deepen the entrance. This great work was commenced in 1817, and happily completed in six years, so that now, as Hörschelmann states, the largest merchantmen can proceed direct to Stettin without unloading any part of their cargoes. Nearly 1000 ships annually enter the river. Swinemünde is a pleasant town, with nearly 4000 inhabitants, who are for the most part fishermen, pilots, and sailors. The pilots form a distinct guild under a commander: they have a watchtower on the coast, and are bound to look out for and announce the arrival of ships, as well as to bring them into the harbour. The town has a considerable trade, and many merchantmen are built here. It has become of late years a much frequented watering-place. (Müller's *Worterbuch;* Cannabich; Stein, &c.)

SWINFORD. [STAFFORDSHIRE.]

SWITZERLAND (called in German, *Die Schweitz;* in French, *La Suisse;* and in Italian, *La Svizzera*), is situated between 45° 48′ and 47° 49′ N. lat., and between 5° 55′ and 10° 30′ E. long. France extends along its north-western border between Basel on the Rhine and Geneva on the Rhône. The boundary-line is partly formed by one of the ridges of the Jura Mountains, and partly by the course of the river Doubs, an affluent of the Rhône. At two places it is quite conventional. On the south of Switzerland are the continental possessions of the king of Sardinia and Austrian Lombardy. The boundary-line between Switzerland and the Sardinian states is marked by strong natural features, except at the western extremity, where the territories of the canton of Geneva are surrounded by Savoy. Farther east lies the Lake of Geneva, and towards its eastern recess, where a high range of the Alps terminates on the banks of the lake near S. Gingolph, the boundary-line runs southward along this high range, until it meets the northern extremity of the mountain-mass of Mont Blanc. From Mont Blanc it turns eastward and extends along the higher part of the Pennine Alps to Mount Rosa, where it trends to the north-east along the Lepontian Alps to the great mountain-knot which surrounds the St. Gothard Pass. From this mountain-knot it runs first southward along a range of mountains, and afterwards south-east over mountains and valleys to the Lago Maggiore. East of that lake the territories of Austria begin. The boundary here runs first southward to the south-western arm of the Lake of Lugano, the central portion of which lake belongs to Switzerland, whilst the south-western and north-eastern extremities belong to Austria. A tract of country which extends several miles south of the southern banks of the Lake of Lugano is included in Switzerland. On the north banks of the lake, about four miles east of the town of Lugano begins a mountain-range, which runs nearly due north, and separating the valleys of Misocco and Giacomo, forms the boundary: Misocco, to the west, belongs to Switzerland, and Giacomo, to the east, belongs to Austrian Lombardy. This mountain-range joins the principal chain of the Rhaetian Alps at the mountain-pass of Splügen. Along the last-mentioned chain the boundary extends only for a few miles; it then runs east of south along a lateral range, crosses the valley of Bregaglia a few miles above Chiavenna, and thus reaches the most southern of the three great chains of the Rhaetian Alps, which is known by the name of the Bernina range. It does not however exactly follow the water-shed along this range, for the valleys of Poschiavo and Münster, belonging to Switzerland, lie between the south declivities, and that of Livigno, which constitutes part of Lombardy, on the north side of the range. The valley of Münster borders on Tyrol, and from its southern extremity the boundary runs northward along an elevated chain of the Bernina range, and after crossing the valley of the river Inn, reaches the central chain of the Rhaetian Alps. It runs along this chain south-west until it meets that lateral chain which is called by the name of Rhaeticon, and which runs north-west between the Prätigau on the south-west, and the Montafoner valley on the north-east. The first belongs to Switzerland, and the second to Austria. The elevated mountains of the Rhäticon terminate on the banks of the Rhine north of Meyenfeld. The Rhine up to the place where it enters the Lake of Constance constitutes the boundary between Austria and Switzerland. On the north-east the Lake of Constance separates Switzerland from the kingdoms of Bavaria and Würtemberg. On the north of Switzerland extends the duchy of Baden, and the boundary is formed by the Rhine, except that at four places some territories belonging to Switzerland lie north of the river, and the town of Constance, which belongs to Baden, is on the south banks of the lake.

Switzerland extends a little more than 180 miles near 46° 30′ N. lat., where its length from west to east is greatest, and about 130 miles at 9° E. long., where it is widest. The area of Switzerland is about 16,000 square miles: it exceeds half the area of Scotland, including the islands, by 1414 square miles, and is nearly equal to twice the area of Wales. The surface of Switzerland presents a greater variety than most countries of Europe. The highest of its mountains, Mount Rosa, attains an elevation of 15,154 feet above the sea-level, while the surface of the Rhine at Basel is only 800 feet, and that of the Lago Maggiore, on the southern boundary, only 678 feet above the sea. The greater part of the country is mountainous. The ranges of the Alps and their numerous offsets extend over the southern and south-eastern districts, and occupy about one-half of Switzerland. Along its western boundary run the ridges of the Jura Mountains. The country between these two mountain-systems has, towards the south, the form of a plain, interspersed with isolated hills; and towards the north it is traversed by ridges or groups of hills of moderate elevation. Thus Switzerland is naturally divided into four regions: the Alps, the Plain, the Hilly Country, and the Jura Mountains.

The *Region of the Alps*, which is the most extensive, is divided from the Plain and Hilly Country by a line which begins on the north bank of the Lake of Geneva, at the town of Vevay, and running north by east passes over Mount Molesson, which may be considered as the most western summit connected with the Alps in these parts. It traverses the river Saane at Gruyère, north-east of Mount Molesson, and thence runs east by north to the western

extremity of the lake of Thun. From the northern shores of the lake of Thun it runs again north by east to Mount Napf, which is on the boundary-line between the cantons of Bern and Luzern, near 47° N. lat. and 8° E. long. From Mount Napf it runs due east to the northern extremity of the lake of Luzern, and thence east by north, crossing the lake of Zug to Mount Hoch Ezel, which is near the most southern part of the lake of Zürich. From this point it follows the depression which runs east by south from the lake of Zürich through the valley of the Limmat, the lake of Wallenstadt, and the low ground which extends from the eastern extremity of the last-mentioned lake to Sargans and the banks of the Rhine. [RHINE, vol. xix., p. 459.] The whole country south of this line is occupied by the mountain-masses and chains of the Alps, and only a small portion of it is cultivable; a larger portion, which is on the upper declivities of the mountains, is available as pasture-ground.

The natural division of the Alps of Switzerland is formed by the immense mountain-knot which is on the west of the mountain-pass of the Saint Gothard, and surrounds the sources of the Rhône. A space exceeding 100 square miles rises above the snow-line, and is overtopped by numerous pointed summits, rising from 10,000 to 12,000 feet above the sea. The most remarkable of these summits are the Gallenstock, the Gletscherhorn, the Diechtenhorn, the Triftenstock, the Süstenhorn, and the Spitzliberg. From this mountain-knot a chain runs northward, and terminates at the narrow channel which connects the lake of Uri with that of Luzern. This chain contains several lofty summits, among which is the Titlis, 11,406 feet high, and the Urner Rothstock, 10,065 feet high. The chain which extends southward from the mountain-knot between Val Formazza on the west and Valle Maggia on the east does not contain any summit which rises above the snow-line, though several of them are between 6000 and 7000 feet high. From the western edge of the mountain-knot issue two ranges, of which the northern, called the Bernese Alps, runs west by south; and the southern, called the Lepontian Alps, runs south-west. Two other ranges branch off from the east side of the mountain-knot. The southern, which runs nearly east, is called the Rhaetian Alps, and near 9° 50′ E. long. divides into two ranges, of which the northern is called the Septimer Alps, and the southern the Bernina Alps. These two ranges however do not run east, but north-east, and extend beyond the boundary-line of Switzerland into Tyrol. The northern range, branching off from the mountain-knot of the Saint Gothard on the east, is also comprehended under the general name of the Rhaetian Alps, but has lately received the name of the Range of the Dödi, from its highest summit. It runs north-east, and terminates near the banks of the Rhine between 46° 40′ and 47° N. lat. These mountain-regions and the vallies enclosed between them differ considerably in their productive powers.

The valley of Wallis is enclosed by the two most elevated and widest ranges of the Alps, the Lepontian and Pennine Alps on the south, and the Bernese Alps on the north. The southern range runs from the great mountain-knot south-south-west, as far as the mountain-pass of the Simplon, a distance of about 30 miles, and so far it bears the name of the Lepontian Alps. This part of the range is not distinguished either by elevation or width. Its mean elevation is about 7500 feet, but several summits attain 10,000 feet. The width of the mountain-masses in general does not exceed 10 miles, for that is about the general distance between the inhabited places in Wallis and in Val Formazza. There are several glaciers, but none of them of great extent. Some of them descend to the vicinity of the Pass of the Simplon, over which the great road leads from Wallis to Italy.

This road, which is considered one of the most magnificent works of modern times, was made by the French government between 1800 and 1805. It connects the town of Briegg in Wallis with Domo d'Ossola, in the valley of the river Toce, or Tosa, in Piedmont, and is about 38 miles long. The width is about 9 yards, and its rise and fall only about 1½ inch for every yard, so that it can easily be passed by carriages. It runs in most places between steep and nearly perpendicular rocks, and at six places tunnels or galleries have been made through the rock. The longest tunnel, which is below Gondo on the side of Italy, is nearly 500 feet long. These tunnels are generally 30 feet high, and at least as wide as the road itself. There are openings on the sides by which they receive the light. In several other places the road traverses precipices of great depth, by means of substantial bridges. The highest part of the road is 6576 feet above the sea-level: Briegg is 2334 feet, and Domo d'Ossola 1004 feet above the sea-level. At certain seasons the waters descend from the glaciers in rapid torrents, and frequently carry away the bridges; the road is also much damaged by the avalanches and masses of rocks which fall from the adjacent mountains. It is supposed that from 5000*l.* to 6000*l.* are annually required to keep it in repair.

West of the Pass of the Simplon are the Pennine Alps, which rise much higher, and occupy a much greater surface. The highest part of this range extends from the Pass of the Simplon, nearly due south, about twenty miles, to the enormous mountain-mass of Mount Rosa, where it turns west, and in that direction extends to the northern part of the mountain-mass of Mount Blanc. [BLANC, MOUNT.] With the exception of two or three passes not much exceeding the elevation of 8000 feet above the sea-level, the general elevation approaches to the height of 10,000 feet above the sea, and the higher part of this range, with the exception of the passes, is covered with snow all the year round. This elevated mountain-tract is of great extent. On its eastern edge are the summits of Monte Parabranco, Cima de Jazzi (13,840 feet high), and Mount Rosa (15,158 feet); and on its southern edge, Mount Cervin (14,764 feet), Mount Combin (14,126 feet), and Mount Velan (11,043 feet), and several other summits of equal elevation. Towards the east and south the mountains descend with a rapid declivity, and the valleys on that side in Piedmont are inhabited to the vicinity of the most elevated mass. But on the north the high masses extend many miles without falling below the snow-line, and are overtopped by many summits rising to the height of 12,000 feet above the sea. They terminate about six miles from the banks of the Rhône, which drains the valley of Wallis. A tract between the Simplon on the east and Mount Combin on the west, and measuring in that direction 30 miles, with an average breadth of 15 miles, is covered with snow, ice, and glaciers. These masses extend therefore over a surface of about 450 square miles, and this whole tract contains only two valleys which are inhabited. They are the valleys of Saas and S. Nicolai, and begin at the northern base of Mount Rosa, whence they extend northward, and uniting about 5 miles from the banks of the Rhône, are called the Valley of Visp. Between Mount Combin and the mountain-masses of Mount Blanc, a distance of about 12 miles in a straight line, the snow-covered portion of the range occupies a comparatively small area, and the inhabited places on both sides of the range are only four or five miles from one another.

The valley of the Rhône lies north of the mountain-region which has just been described. This river originates in the Rhône Glacier, an immense field of ice lying on the mountain-knot west of the Pass of St. Gothard, and south of the summit of the Gallenstock (12,023 feet). Where the river issues from under the ice, it is 4930 feet above the sea-level, or more than 500 feet higher than the summit of Ben Nevis. The upper part of its course, as far as Briegg, about 24 miles in length, is from north-east to south-west. Below Briegg it runs about 48 miles to Martigny, in a direction west by south. Near Martigny it forms a right angle, and the remainder of its course to its influx into the Lake of Geneva is to the east of north, and about 20 miles. The whole valley therefore is about 92 miles long. Its eastern portion, as far down as Briegg, varies between a quarter and half a mile in width. Below Briegg, and especially below the confluence of the Rhône with the Visp, which is the larger of the two rivers, the valley is from one to two miles wide, and in a few places the width is greater. Besides the valley of the Visp, the branches of which are inhabited to the distance of 18 miles from the river, several lateral valleys open into that of the Rhône, which are from a quarter to half a mile wide, and inhabited to the extent of six miles from the banks of the river. They occur in both the southern and northern mountain-chains, and thus the inhabited portion of this part of the country occupies about 12 miles in width. But between Sion and Martigny the unbroken mountain-masses approach the river, and the inhabited tract is not more than two or three miles wide. Below the great bend, the rocky masses of the Dent de Morcles on the east, and of the Dent du Midi on the west, approach so near to

the river, that in several places there is hardly room enough for a road along the banks of the stream. About eight miles from its influx into the Lake of Geneva, the low tract along the banks of the river becomes two miles wide. It is a swampy tract, very little elevated above the level of the lake, which is about 1210 feet above the sea-level. The descent of the valley amounts to 3720 feet, but this alone will not account for the great diversity of climate between the higher and lower parts of it. Above Briegg the corn remains in the fields till the beginning of October, and it is reaped west of Sion in the month of June. The climate in the higher parts is cold, even in summer; whilst in the lower, at the same season, the thermometer frequently rises to 88° and 90°. This great difference can only be accounted for by the circumstance, that immense glaciers approach very near the inhabited places of the higher districts, whilst the lower portion of the valley is at a considerable distance from the ice-covered mountains, and immediately surrounded by high and nearly perpendicular rocks, which reflect the rays of the sun. Only the common grains and roots of northern Europe are cultivated above Briegg, and some fruit-trees do not grow: the lower districts produce maize; and the vine, almond, and fig-tree flourish.

On the northern side of the valley of the Rhône are the Bernese Alps, the most elevated edge of which is parallel to the course of the river. Their eastern extremity is formed by a ridge called the Grimsel, over which a mule-road leads from the valley of Hasli to that of the Rhône. The highest part of this road is 8300 feet above the level of the sea. To the west of the Grimsel and the valley of Hasli begins the largest continuous mass of ice and snow on the Alps. It extends on both sides of the highest edge of the range, and occupies from east to west, from the valley of Hasli to that of Kander, a space 30 miles long in a straight line, and from north to south a space of about 20 miles, occupying nearly the whole of the country between the lakes of Brienz and Thun and the valley of the Rhône. Its area is about 600 square miles. The outer edges of this region only are indented by three short valleys, which are inhabited. One of them, the valley of Lötsch, opens towards the south into the valley of the Rhône, and two open towards the north, into that of the Aar. The two last-mentioned are the valleys of Grindelwald and Lauterbrunnen, which are annually visited by many foreigners, as they offer the most easy access to the glaciers. From this immense lake of ice rise numerous summits, chiefly in the form of pyramids: along the highest portion of the region, from east to west, are the Finsteraarhorn (14,107 feet), the Mönch, or Monk (13,502 feet), the Jungfrau, or Virgin (13,621 feet), the Breithorn (12,462 feet), the Altels (12,172 feet), the Rinderhorn (11,683 feet), the Wildstrubel (10,980 feet), and between them several others hardly inferior in elevation. To the north of this series are other summits, among which the highest are the Eiger (12,922 feet), the Schreckhorn (13,444 feet), the Wetterhorn (12,220 feet), the Blumlis Alp (12,145 feet), and the Dolderhorn (11,920 feet). The Faulhorn, not far from the lake of Brienz, rises only to 8750 feet, but it is frequently ascended by travellers on account of the magnificent view which it offers of the numerous mountains and glaciers which lie to the south of it. At the western extremity of this region a road leads from the valley of the Kander to the valley of Lötsch in Wallis. It traverses the ridge called the Gemmi, and in its most elevated point rises 6446 feet above the sea. It is partly cut through rocks, and only practicable for beasts of burden.

The valley of the Kander separates this region from that which lies farther west, and in which the Alps rise above the snow-line only in a few places. The highest part of the mountains continues to run south-west, as far as the three-headed summit, called the Diablerets, or the Teufelshörner, which is nearly due north of the great bend of the Rhône and somewhat more than 12 miles from it. The passes over this chain vary between 3000 and 5000 feet in elevation, but some of the summits rise above the snow-line and attain more than 10,000 feet. The highest summits from east to west are the Gletscherhorn (10,393 feet), the Wildhorn (10,724 feet), the Arpelhorn (10,948 feet), and the Diablerets (10,447 feet). At the Diablerets the chain divides into two branches, one of which runs south-south-west and terminates on the banks of the Rhône, opposite the Dent du Midi, in high rocks, and the other extends westward towards the eastern extremity of the Lake of Geneva, and in approaching the lake turns gradually to the north and terminates in Mount Molesson (6577 feet). In the first of these two chains is Mount Möreran (9882 feet) and the Dent des Morcles (9567 feet), and in the second Mount Oldenhorn (10,362 feet). Though these summits and a few others rise above the snow-line, they occur at considerable distances from one another, and the glaciers which surround them are of comparatively small extent.

The country which extends north of this range, between the river Kander on the east and the Saane river on the west, and terminates in the parallel of the northern extremity of the Lake of Thun, is a mountainous country: but it does not appear that the summits which are always covered with snow are numerous; several of them attain an elevation of 8000 feet above the sea-level, and from 4000 to 5000 feet above their base. The form also of these mountains differs from that of the higher Alps, their summits not terminating in peaks or sharp ridges, but being rounded and rather flat at the top: the declivities are generally steep, though much less so than those of the higher mountains. In many places the higher parts of the ridges and groups are above the line of vegetation, but as the lower declivities are covered with fine grass, which supplies excellent pasture during the summer months, and with trees, this region contains a much greater portion of productive land than the other parts of the Alps, though the proportion which is cultivated is very small. It is eminently a country of pasture. The highest and most continuous ridge of mountains in this country is that which lies nearest to the preceding region, and extends to the west of the valley of the Kander, from the great range to the banks of the lake of Thun, where it terminates in Mount Niesen (7824 feet), whence it is called the Niesen range, though some of the summits rise 300 or 400 feet higher. Among the isolated summits is the Stockhorn, which is west of the lake of Thun, on the border of the mountain region: it is 7213 feet high, and is frequently visited by travellers on account of the extensive prospect from its summit.

The valley of Hasli, at the most southern extremity of which the river Aar originates in the Aar Glacier [RHINE, vol. xix., 459], lies between the largest fields of ice and snow, and extends in the form of a semicircle more than 20 miles to the influx of the Aar into the lake of Brienz. The climate is not so cold as might be supposed, because the glaciers do not approach the immediate vicinity of the valley, but are separated from it by lower mountains which form the declivities of the snow-covered masses. Though the valley in the upper parts is only between a quarter and half a mile wide, and in the lower between half a mile and a mile, several short valleys open into it from all sides, and the declivities of the mountains which enclose these lateral valleys, and those of the principal valley, contain rich pasture. The lower part of the valley is partly cultivated and partly meadow-ground. There are extensive plantations of walnut-trees. Along the northern banks of the lake of Brienz, the offsets of the Faulhorn rise with a steep acclivity, leaving little ground for cultivation and pasture; but to the north of the lake a hilly tract, partly cultivated and partly used as pasture-ground, intervenes between the lake and the mountains. The low and level tract which lies between the lakes of Brienz and Thun, and is about four miles long and two miles wide, is fertile, well cultivated, and has extensive plantations of walnut-trees. The climate is so temperate that the flowers blossom in the month of February. Along the northern banks of the lake of Thun the mountains approach close to the water; but as they are not high, nor their sides precipitous, there is a considerable tract between them and the lake, which is used for the cultivation of grain, plantations of vines and trees, and as pasture-ground. There is a similar tract of greater extent on the south of the lake; and towards the western extremity of the lake the mountains disappear and the plain begins.

The country which extends north-east of the river Aar and the lakes of Brienz and Thun to the lake of Luzern, and eastward to the high range which runs northward from Mount Titlis to the strait which connects the lake of Uri with that of Luzern, is much less mountainous and broken than the region which is south of the lake of Thun. The lake of Brienz is 2060 feet above the sea-level, that of Thun 1875 feet, and the lake of Luzern 1434 feet; and consequently the mean elevation of this region can hardly be estimated at less than 2000 feet. The most elevated tract is north of the lake of Brienz, where the Rothhorn attains 7536 feet above the sea, the Tannhorn 6962 feet, and the

Hohgant 7352 feet. These summits may be considered as the most northern range of the Alps in this direction, for the numerous summits which are dispersed over the country north of them are generally isolated, and hardly attain an elevation which entitles them to the name of mountains in the vicinity of the high masses lying farther south. The highest of them, Mount Pilatus, south-west of the town of Luzern, is only 6904 feet above the sea-level; and Mount Napf, which is the north-western point of this region, is only 5277 feet. The surface of this country is a succession of ascents and descents, with very small tracts of level ground between them. Though the declivities cannot be called steep, they are too rapid to admit of the use of the plough, and hence nearly the whole of the country is pasture-ground, except that in the vicinity of the lake of Luzern large tracts are planted with walnut and chestnut trees.

We now pass to the eastern portion of the mountain-region. Along the eastern edge of the mountain-knot, west of the pass of St. Gothard, lies the valley of the Upper Reuss, of which a more minute description is given under RIVERS, vol. xx., p. 23. The upper part of the valley, or that of Ursern, is extremely cold, being in its lowest part 4644 feet above the sea-level; the lowest part, or the valley of Uri, has a very temperate climate, being little elevated above the surface of the lake of Luzern, or about 1500 feet above the sea. In the valley of Ursern the winter lasts eight months, and even during the remainder of the year a fire is constantly kept up. No grain is cultivated, but there are good pastures. The climate of the valley of Uri resembles that of Giornico, in the valley of Leventina, south of the Alps: the valley produces maize and other grain, and also peaches and chestnuts. The highest part of the mountain-road of the St. Gothard, which passes through this valley, is about 7100 feet above the sea.

The country between the valley of the Reuss and the lake of Luzern on the west, that of Wallenstadt on the north, and the valley of the Upper Rhine on the east and south, is probably the most broken portion of the mountain-region of the Alps in Switzerland. The valleys are extremely narrow, and the declivity of the surrounding mountains is exceedingly broken, and so steep that large tracts on the mountains' sides are bare of trees and bushes, and only a very small surface is fit for pasture. The upper part of the mountains consists either of sharp narrow ridges or of isolated summits, which generally constitute large masses with a very uneven surface. The mountains, though connected with one another by ridges, are not disposed in regular ranges, but scattered over the surface in the greatest disorder, except along the valley of the Rhine, where they form a tolerably continuous range. This range, the most northern of the three ranges comprehended under the name of the Rhaetian Alps, and now commonly called the range of the Dödi, is connected with the mountains which line the valley of the Aar on the east, and thence runs east-north-east over the Krispalt, the Oberalpenstock (10,873 feet), the Dödi (11,811 feet), the Kistenberg (11,068 feet), the Scheibe (10,000 feet), and the Graue Hörner (9338 feet), terminating near the Rhine, and on both sides of the deep and closed valley of the Tamina, in precipitous masses of rock. The glaciers on this chain are numerous, but with the exception of those which surround the Dödi and Kistenberg, they are not of great extent. In the country north of this range there is also a considerable number of single mountains, which rise above the snow-line, as the Windgellen (10,336 feet), the Scheerhorn (10,809 feet), the Clariden Alps (10,489), the three mountains of Glärnisch, of which the most elevated, Hoch Glärnisch, rises to 9509 feet, the Kärpfstock (8954 feet), and several others. But as these mountains are isolated, the glaciers are of small extent. The mountains are less elevated along the northern edge of this region, as the Mürtschenstock, which runs along the southern banks of the lake of Wallenstadt, and attains an elevation of 7750 feet above the sea-level. In proceeding north-west, the mountains decrease in elevation, and their declivities are much more gentle. North-west of a line drawn from the narrow strait which unites the lake of Uri to that of Luzern, to the western extremity of the lake of Wallenstadt, there is no mountain which is covered with snow all the year round, and only a few occur whose summits are above the region of trees. But though the declivities of the mountains are generally accessible to cattle, and supply pasture-ground, few places are cultivated. There are however some large tracts which are planted with vines and other fruit-trees, especially in the more mountainous part, where the peach-trees are very numerous. The narrow valleys of this tract have a temperate climate, and the winters last only two or three months.

The valley of the Upper Rhine extends along the Rhine from its source in Mount Badus [RHINE, vol. xix., p. 459] to its influx into the lake of Constance, or the Boden See. This valley is about 90 miles long: nearly one-half of that distance is from west-south-west to east-north-east, and the remainder is from south to north. The upper part of the valley is formed by a few basins of an oval form, from 3 to 4 miles long, and from 1½ to 2 miles wide. These basins are separated from one another by mountains, which generally come close to the banks of the river. The highest of these basins occurs near Trons, where the surface of the river is 2829 feet above the sea-level. That portion of the valley which lies above Trons is not cultivated, partly on account of the steep declivity of the mountains, and partly owing to the rigour of the climate: the winter lasts from eight to nine months. At Trons agriculture begins, but it is on a very moderate scale, as a part of the basin is covered with swamps. Lower down are the basins of Ilanz and of Reichenau, and then follows the basin of Chur, where the lower portion of the valley begins. This lower valley is divided into two parts by two mountains, the Fäscherberg on the east, and the Schollberg on the west, which come close up to the river north of Meyenfeld, near 47° 5′ N. lat. The southern district, called the Valley of Meyenfeld, descends gradually from about 1775 to 1600 feet. It is about 15 miles long, and varies in width from 2 to 3 miles: the whole of it is under cultivation, and it produces maize, wheat, and other grains; and near the base of the adjacent mountains there are vines and fruit-trees. The northern portion of the valley, called the Rheinthal, or Vale of the Rhine, is about 30 miles long, and from 3 to 6 wide; but only the smaller part of it, which extends along the western banks of the river, belongs to Switzerland: the low country east of the river, which is much wider, belongs to Austria. It is one of the best cultivated tracts in Switzerland, and produces very large quantities of maize and other grains. The vine and fruit-trees are abundant. Great quantities of cider are made and exported. The descent of the valley is from 1600 to 1340 feet above the sea-level.

The principal range of the Rhaetian Alps branches off to the east of the mountain-pass of St. Gothard, south of Mount Badus, and runs eastwards. It is less known than the other ranges of the Alps, and only a few of its numerous summits have been measured. A continuous range of mountains, of which however no summit seems to rise above the snow-line, extends 20 miles, to Piz (Peak) Valrhin, which attains an elevation of 10,960 feet, and is surrounded by extensive glaciers, which are the source of the Hinter-Rhein, the largest of the upper branches of the Rhine. Not far from it to the east is the Muschelhorn (10,234 feet); and between the roads leading over the St. Bernhardin and the Splügen is the Tambohorn (10,436 feet). The range continues eastward to the source of the Inn, where it turns to the north of north-east, in which direction it runs to the eastern frontier of Switzerland, and enters Tyrol. This last portion of the range is very high, and the snow along the crest is almost continuous. Some of the glaciers are extensive, especially as we approach the eastern boundary of Switzerland: the glacier which surrounds Mount Fermund, or the Iron Mountain, is calculated to cover nearly 100 square miles. From this immense field of ice and snow that range of mountains branches off which is called Rhäticon, and which runs north-west by west until it terminates on the Rhine with the Fäscherberg, north of Meyenfeld. The crest of this mountain-wall, which is about 10 miles wide and 30 miles long, is generally above the snow-line, and glaciers descend down its sides. The most elevated summit, the Scesa Plana, is 9818 feet above the sea-level. The Rhäticon divides Switzerland from Vorarlberg.

The country between the ranges just described and the valley of the Upper Rhine extends from the Piz Valrhin to the Rhäticon, more than 40 miles in length, and about 24 miles in width: it is filled with extensive mountain-masses, which are connected with the principal range by lower ridges. These lower ridges sometimes constitute ranges several miles long, rising above the snow-line, and covered with glaciers. Only a few of their summits have been measured, among which the Zaporthorn, north of Piz Valrhin, rises to 10,841 feet; and the Piz Beverina, on the

west of the valley of the Hinter-Rhein, and south of Reichenau, to 8933 feet. The valleys which lie between these ranges and mountain-masses are very numerous, but they rarely exceed half a mile in width. The larger valleys are from west to east: the valley of Lugueza, which opens into the valley of the Rhine at Ilanz; that of the Hinter-Rhein, which terminates near Reichenau; and that of the Languart, called the Prätigau, which joins the valley of the Rhine above Meyenfeld, and extends along the southern declivity of the Rhäticon. Very little grain is cultivated in these valleys, but potatoes and other vegetables are grown. Fruit-trees do not succeed, except in the lower parts. Most of them however have excellent pasture-grounds on the Alps, and the level tracts are converted into artificial meadows, which are irrigated. The valley of the Hinter-Rhein is the longest: the great roads between Coir or Chur and Italy pass through it. A road leads from Chur to the village of Splügen, where it divides. The western road passes over the Bernhardin and leads to Bellinzona, in the canton of Tessin: the highest point of this road is 6961 feet above the sea. The eastern road traverses the Splügen and leads to Chiavenna, in the valley of Bregaglia, in the Austrian province of Sondrio: the highest part is 6715 feet above the sea. Both roads are passable for carriages, and a considerable traffic is carried on by them between the manufacturing districts in the northern parts of Switzerland and Italy.

The southern chain of the Rhaetian Alps, called the Bernina range, which name is derived from a mountain-pass over which a road leads from the valley of Engadin into Italy, runs parallel to the principal range from south-south-west to north-north-east: its southern extremity extends into Lombardy, and the northern into Tyrol. It appears to be as high as the principal range, for a great part of the most elevated ridges are always covered with snow, and contain numerous glaciers. The most elevated summit is said to be that called Monte dell' Oro, which stands south of, and not far from, the boundary-line of Switzerland, within the Austrian dominions. Between the Bernina range and the principal range of the Rhaetian Alps the beautiful pastoral valley of Engadin is enclosed. [ENGADIN.] On the southern declivity of the Bernina range only two valleys of some extent belong to Switzerland: the valley of Münster, which opens into the valley of the Adige at Glurns in Tyrol; and the valley of Poschiavo, which is 15 miles long, and opens into the valley of the Adda at Tirano, in the province of Sondrio. The valley of Poschiavo is a rich pastoral district, and derives considerable advantage from the road over the Bernina Pass, which runs through it. Large droves of cattle go by this road from the valley of Engadin to Italy.

Numerous rivers rise on the southern declivities of the Rhaetian Alps, between the great field of ice in which the Aar and Rhone originate, and flow southward: they all unite in the river Tessin or Ticino. The country drained by these rivers is called Italian Switzerland, because the Italian language is spoken by the inhabitants. It is traversed by several mountain-ranges, which run southward and occupy the greater part of its area. Many parts of these ranges rise above the line of trees and shrubs, but none of the summits attain the snow-line. Between the ranges there are several valleys of considerable extent: three largest are those of Misocco, Leventina, and Maggia. The largest is the valley of Leventina, of which a description is given under RIVERS (vol. xx., p. 23). Each of the other two valleys is about 25 miles long, and varies in width from 1 to 2 miles. All these valleys are very fertile. In their upper parts, which are about 3000 feet above the sea-level, very little grain is cultivated, and the inhabitants live on the produce of their herds. In the middle parts of the valleys maize and other kinds of grain are grown, and vines and fruit-trees abound, especially the chestnut and walnut tree. The lower parts, whose climate approaches that of Italy, have considerable plantations of fig-trees and mulberry-trees. A considerable quantity of silk is annually collected in these valleys and sent to the manufacturing districts: no other part of Switzerland contains such extensive forests and such fine trees. The great road which traverses the mountain-pass of Saint Gothard runs through the valley of Leventina, and that which crosses the St. Bernhardin through the valley of Misocco. As the southern declivity of the Alps is very steep, these valleys are subject to very extensive and destructive inundations during heavy rains.

There is a considerable difference of climate between the southern and northern declivities of the Alps. On the declivity, which descends rapidly towards Italy, the snow-line occurs at the elevation of about 9000 feet: on the northern side it does not rise above 8000 feet above the sea. Rye and barley succeed on the northern declivity only in a few places in situations more than 3000 feet high: on the southern slope they are cultivated to 4000 and even 4500 feet: on the north, maize is grown to 1500 feet; and in some places even at a higher elevation: on the south it rises to nearly 3000 feet. Mulberry-trees are only found on the southern declivity, on which they ascend to nearly 2000 feet. On the north chestnut-trees cease at 2500 feet, but extend on the south to 3500 feet. Common fruit-trees succeed on the north to 3800 feet, and on the south nearly to 4000 feet above the sea. Potatoes, carrots, turnips, and cabbages are grown to the height of 5000 feet on the north. Full-grown trees are met with on the northern side to 4500, but on the southern up to 6000 feet.

Agriculture is not limited to the level tracts on the banks of the rivers in the larger valleys, but it extends over the lower parts of the declivities. The whole declivity of the mountains is naturally divided into four regions: the lower, the wooded, the alp or pasture, and the rocky region.

A steep ascent leads from the low and level tract of the valley to the *lower region*. This ascent is generally covered with trees or bushes. The surface of the lower region rises by a gentle slope for a considerable distance, occupying generally only one-eighth of the elevation of the mountain, and one-third of its area. The surface is covered with a thick layer of earth, which has been brought down from the more elevated parts, and has been prevented from descending lower by the gentle slope of the ground. The surface of this tract is rather undulating, and is only furrowed by the beds of the torrents which traverse it on their descent from the high regions. The cuts made by these torrents are deeper the nearer they approach the low tract on the valley. The greater part of this region is rather fertile, without wood, and fit for cultivation where the valley is not too much elevated above the sea. On this slope alone permanent habitations are found, and it is traversed by the roads which connect the villages or hamlets.

At the back of the lower region rises the *wooded region*, which, being very steep, is not adapted for cultivation. It occupies in height half the elevation of the mountain, but only one-third of its base in width. On an average, the angle at which it rises is 45°; and often more. In general it is covered with full-grown trees, which cannot be turned to profit because of the difficulty of bringing them down. The steepest parts of the rocks have no covering except lichens and mosses.

Above the wooded region is the *alp* or *pasture region*, which occupies in height only one-eighth of the declivity, and in width about one-sixth. The slope is much more rapid than that of the lower region, and its surface presents considerable inequalities. There are few trees on it, but some places are covered with low bushes, dwarf willows, and firs. It bears a rich turf and many plants, among which the Alpine rose (Rhododendron ferrugineum) is admired for the beauty of its flower. For three or four months in summer cattle pasture on this region, which is divided into regular portions, properly called *alps*. There are some brooks and small ponds, but in general water is not abundant, and it disappears during the dry weather in summer, and herdsmen are obliged to take the cattle lower down to water them. No part of this region is permanently inhabited, but there are many small huts of stones or wood in which the herdsmen pass the summer, while the cattle are on these pastures. In winter this region is covered with a thick layer of snow. Though the grass is very nourishing, it is short, and consequently a much greater space is required to feed an animal than on the less elevated region between the lake of Thun and that of Luzern.

The *rocky region*, which composes the crest of the mountain, is always destitute of vegetation. This region occupies about one-fourth of the height of the declivity, and one-sixth of its width. It is however of smaller dimensions, and sometimes it does not exist at all on mountains whose summits do not attain the highest line of vegetation. In such a case the crest of the mountain resembles the alp region.

The valleys which are above the size of ravines have a peculiar form. The smaller valleys consist of one basin,

from 2 to 5 miles in length, and from one-eighth to a quarter of a mile in width. This basin is enclosed by rocky masses, in which the four regions are distinctly marked, and is connected with the valley, into which it opens by a very narrow gorge, frequently more than a mile in length, through which the rivulet which drains the basin runs, and which in most places is hardly wide enough to convey the water to the wider valley. The surface of the basin is sometimes a dead level; in other places it has a slight slope towards the stream. These basins at some remote period have apparently been filled with water, and formed lakes, and by some revolution the gorge has been opened, the water was drawn off, and the surface of the basin laid dry. Frequently a small lake is still found in the lowest part of the basin, and in others the lowest part of the basin is under water when rain or the melting of the snow increases the volume of water in the rivulet so that it cannot be carried off by the narrow gorge by which it issues from the basin. At some places it has been found necessary to make embankments along the rivulets to protect the fields against inundations. The larger valleys consist of from three to five of such basins, which rise like terraces one above the other towards the source of the river. Thus the Hinter-Rhein runs first for about six miles in a ravine, and then enters a basin, which is from one mile to two miles wide and about 24 miles long, and called the valley of the Rhinwald. The hamlet of Hinter-Rhein, which is near the place where the basin begins, is 5000 feet above the sea-level; but the village of Splügen, not far from its lower extremity, is only a little more than 3000 feet. About two miles below this village the valley is shut up by mountains, and between them the river runs for about three or four miles through a very narrow gorge, called the Rofflen, in which the road is made on the declivity of the adjacent mountains, there being not space enough for it along the banks of the river. Below the Rofflen is the second basin, called the valley of Schams, a fertile and beautiful valley of an oval form, about five miles long and two wide, which at its lower extremity is separated from the third basin by another narrow gorge similar to the Rofflen, and called Mala Via. The third basin is about six miles long and three wide, and called the valley of Domleschge: it is about 2000 feet above the sea-level, and at its lower extremity again closed by a short gorge, which is about 50 yards wide. Issuing from this gorge the Hinter-Rhein joins the Vorder-Rhein, and after this junction the valley of the river in two places is contracted to its very bed, first between Reichenau and Chur, and lower down below Meyenfeld. The soil of the basins generally consists of gravel and peat, which produces good grass, and consequently is used as meadows: it is rarely cultivated, even in those valleys which are less than 3000 feet above the sea-level. The brooks and rivers which drain the valleys traverse the basins generally with a gentle current, but in the gorges they form nearly a continuous rapid, which is frequently interrupted by cataracts.

It thus appears that the rivers of the mountain-region are not navigable, with the exception of the Rhine, which is navigated by river-barges from the town of Reichenau, where its two principal branches unite. But even if their course were not interrupted by cataracts, these rivers could hardly be navigated, owing to the great changes in the volume of water, which occur very suddenly. It frequently happens that in a few hours a river rises several feet and inundates the low tracts contiguous to its banks, and in a few hours it subsides again. These changes sometimes follow very rapidly. Small lakes are very numerous. A few of them occur in the basins of the valleys, but the greater number lie in the mountains, being enclosed by high walls of rocks. Some of them are at such an elevation as to be covered with ice all the year round. Larger lakes do not occur within the mountain-region, with the single exception of the Lake of Brienz, but several of considerable size are found along the outer edge of the region, so that the larger portion of the lake is enclosed by mountains, whilst the lower extremity is within the adjacent plain. Such are the lakes of Luzern and of Thun on the northern, and the Lake of Lugano and the Lago Maggiore on the southern side of the Alps. All Alpine lakes are deep; in some cases the depth is 100 fathoms. They contain few fish.

The *Hilly Region* extends over the north-eastern portion of Switzerland, and comprehends the country which is bounded on the east by the valley of the Rhine, or Rheinthal, on the north-east by the Boden See, or Lake of Constance, and on the north mostly by the course of the Rhine. On the west it is divided from the region of the Jura Mountains by the lower course of the Aar, between the mouth of that river and its confluence with the Reuss. The river Reuss and its tributary the Lorze, which issues from the Lake of Zug, separates the hilly region from the plain. The line dividing the hilly region from the Alps runs from the middle of the Lake of Zug to Mount Hoch Etzel, on the southern banks of the Lake of Zürich, and thence along the depression in which the lower course of the Linth and the Lake of Wallenstadt are situated, and which from that lake extends to the Rhine north of Sargans. This depression, which continues across the western district of the hilly region through the Lake of Zürich and the valley of the Limmat, terminates at the confluence of the last-mentioned river with the Aar. The length of this depression is nearly 70 miles, but half of this space is occupied by the lakes of Wallenstadt and of Zürich, the former of which is 10 miles long, and the latter nearly 24. The level tract which separates the two lakes, and that which lies between the Lake of Wallenstadt and the Rhine, are hardly more than 20 feet above the waters.

Part of the country enclosed by these boundaries is mountainous. This higher tract occupies the eastern portion of the hilly region, and may be divided from the lower country by a straight line drawn from the western extremity of the lake of Wallenstadt to the place where the Rhine enters the lake of Constance. On the northern side of the low and narrow tract between Sargans and the lake of Wallenstadt above noticed, the country rises with a steep ascent to an elevation of between 3600 and 4000 feet, which increases as we proceed westward, and on the northern shores of the lake of Wallenstadt it attains an elevation of 7000 feet above the sea-level. This continuous range, which extends along the northern banks of the lake and descends towards it with a steep declivity, is called the Kuhfirsten or Kurfirsten, and terminates on the west in the elevated summit of Mount Speer (6636 feet). It is about 4 miles wide. Its northern declivity is comparatively gentle. North of the eastern extremity of the lake of Wallenstadt, a lower ridge, called the Grabser Alpen, branches off towards the north and connects the Kuhfirsten with the mountain-group called the Alpstein, which from east to west extends about 10 miles, and whose lower offsets advance to the very shores of the lake of Constance, so that in length it exceeds 15 miles. Towards its southern border are the highest summits, of which the Säntis, or Hoch Säntis, attains an elevation of 8272 feet, and has a small glacier on the northern declivity of its summit. The Alte Mann, which stands east of it, is only about 200 feet lower. North of these summits are several others, rising from 4000 to 6000 feet, but at the distance of 6 miles from the lake of Constance they sink down to 4000 feet, and gradually decrease in height. This mountainous tract resembles very much the country north of the Dödi range, except that the valleys are somewhat wider; and as the mountains do not rise to such an elevation, and have less rapid slopes, the pasture-grounds on the upper declivities are more extensive. Very little grain is cultivated, but there are some fruit-trees and vines.

The remainder of this region can only be called hilly, and its surface is nothing but a succession of high swells with moderately gentle declivities and rounded or flat tops. These swells are sometimes several miles long. In several places round-topped summits rise upon their backs, which are usually more numerous and higher in the vicinity of the mountain-tract, and sink lower as we advance towards the north. None of these high hills exceed 4000 feet above the sea-level, though several rise 3000 feet above the sea, and about 1800 feet above their base. The highest summits are arranged in small chains, which in the western districts are between the river Thur and the lake of Zürich. The most eastern is called the Altmann chain, and divides the valleys of the rivers Thur and Toss. It contains the Schnebelhorn (3923 feet) and the Hörnli (3824 feet), and terminates on the banks of the Rhine opposite Eglisau with the Irchelberg. By means of the Töss-stock it is connected with the Kuhfirsten. The western ridge runs between the lakes of Zürich and Zug, and terminates with the Uetliberg (2850 feet), which stands a short distance west of Zürich. It contains the Schnabelberg (2760 feet) and the Albis (2921 feet). The Albis, which commands an extensive view over all the adjacent countries and the snow-capped mountains of the Finsteraarhorn region, has given its name to this ridge, which is called the Albis chain. This chain is

connected on the south with other summits, which are offsets of the Dödi range, among which is the Rossberg, from which a large mass fell in 1806, and destroyed the village of Goldau. It rises to 5190 feet. South of the Rossberg, between the lakes of Zug and Luzern, stands the isolated summit of the Righi (Regina montium), which is much visited by travellers, and rises to 5916 feet. The two last-mentioned mountains are within the mountain-region. That portion of this region which lies between the lake of Constance and the course of the river Thur is comparatively level, as the hills rise to a very moderate elevation, and their slopes are so gradual that nearly the whole of them is cultivated. This is considered to be the most fertile tract in all Switzerland, especially that part between Arbon on the banks of the lake, and Stein on the Rhine, which presents a succession of cultivated fields, orchards, vineyards, and artificial meadows. Besides maize and all other sorts of grain cultivated north of the Alps, large quantities of hemp and flax are grown, which supply the material for the numerous manufactures here and in the neighbouring districts. Two crops of flax are frequently got in one season from a field. The plantations of fruit-trees are so extensive as to resemble forests, and the trees attain an uncommon size. In several places the meadows are irrigated. The soil of the remainder of this region is less fertile, though in general it is above mediocrity and well cultivated, but a larger portion of the surface is used as pasture and meadow land, as the higher parts of the chains of hills above mentioned are unfit for cultivation, but are used as pastures for six or seven months of the year. The country along the northern banks of the lake of Zürich is very little inferior to the tract along the lake of Constance. There are many small lakes in this hilly country, and they contain more fish than the Alpine lakes. The largest lakes of these are those of Wallenstadt and Zürich. The lake of Wallenstadt, the *Lacus Riparius* of the antients, is still called, in the language of the people of Graubündten, the lake of Ripa. It is 10 miles long, and nowhere exceeds two miles and a half in width. It partakes of the nature of the Alpine lakes, being very deep, in most places from 60 to 80 fathoms. Its northern shores are extremely steep, rocky, and high, and at the distance of barely a mile from them the Kuhfirsten range rises from 4000 to 5000 feet above the sea-level: on the south the shores are also rocky and steep, but less elevated, and the Mörtschenstock range attains its highest elevation at the distance of 2 or 3 miles from the lake: at the two extremities it is bordered by low tracts. The surface is 1424 feet above the sea-level. The lake of Zürich is about 24 miles long, and has the form of a section of a circle, the curvature being directed towards the south-south-west. Its mean width is less than 3 miles. It is divided by two projecting points into two sections, of which the eastern is called Ober See (Upper Lake): the surface is 1310 feet above the sea-level. Near its eastern extremity is a level tract of some extent, but, with this exception, the shores are surrounded by gently-sloping hills, covered with vineyards, orchards, and cultivated fields. In a few places it is stated to be 100 fathoms deep. The largest rivers of this region are the Thur and Limmat. The Thur rises in a valley which separates the Kuhfirsten range from the Alpstein mountains, and at first runs west, but turns gradually to the north. After a course of about 30 miles it makes a great bend to the east, and then flows westward to its confluence with the Rhine above Eglisau. Its whole course exceeds 65 miles. Nearly one-half of its course lies in a narrow but rich pastoral valley, the Toggenburg, between mountains, and the remainder of the course between moderate and well-cultivated or wooded hills. It is too rapid for navigation. The Limmat originates, under the name of the Linth, on the northern declivity of Mount Dödi, and traverses the mountain-region of that name in a northern direction, and in a very narrow valley until it meets the lake of Wallenstadt. Formerly it did not fall into the lake. It is subject to a very sudden and great increase of water, and it frequently inundated the low tract between the lakes of Wallenstadt and Zürich, and destroyed the crops of that fertile district. In 1821 a canal was made, by which the waters of the Linth are now carried to the lake of Wallenstadt, and another canal in the middle of the low tract, which is wide and deep enough to receive all the water from the lake of Wallenstadt and to carry it to the lake of Zürich. This canal is called the Linth canal. The river issuing from the western extremity of the lake of Zürich is called the Limmat. It runs about 18 miles in a west-north-west direction, until it falls into the Aar near Rain. The Limmat is navigated, but it can only be ascended by empty boats, on account of the rapidity of the current.

The *Plain* of Switzerland, which lies to the north-west of the mountain-region and to the west of the hilly-region, extends in the direction of north-east from the banks of the lake of Geneva to the lower course of the Reuss from Roth to its confluence with the Aar. The line which divides it from the mountain-region has already been described, and also that which separates it from the hilly-region. Its western border, with which it joins the Jura Mountains, is marked between the lakes of Geneva and Neuchâtel by a straight line, beginning on the banks of the first-named lake at Rolle, and terminating on the last-mentioned at Yverdun. Farther north it is formed by the lake of Neuchâtel in all its length, and then by the river Thiele (Ziel), or the channel which carried the waters of that lake to the lake of Bienne, by the last-mentioned lake, and by the channel by which it discharges its waters into the Aar, which likewise bears the name of Thiele. The remainder of the western boundary of the plain is formed by the river Aar to its confluence with the Reuss, as the Aar flows along the base of the Jura Mountains in these parts. This plain is properly an immense valley, surrounded by mountains, and extending south-west and north-east more than 100 miles in length, with a width which varies between 20 and 30 miles. Its area probably exceeds 2500 square miles.

On the southern and western border of the plain are four considerable lakes: the lakes of Geneva, Neuchâtel, Morat, and Bienne, which are at different elevations above the sea-level: the lake of Geneva is 1228 feet above the sea, Morat is 1450 feet, Neuchâtel 1429 feet, and Bienne 1410 feet. As the lake of Neuchâtel is fully 200 feet higher than that of Geneva, we should expect to find that the waters originating between the two lakes would run to the lake of Geneva; but we really find that the watershed between these lakes is never more than 2 miles from the lake of Geneva, and that nearly the whole drainage runs to the lakes of Neuchâtel and Morat. This is effected by a high swell, which extends westward from the Dent de Jaman, the most western summit of the Alps in this part of Switzerland, to the lake of Geneva, between Montreux and Vevay. It proceeds westward along the lake, and close to its banks, to Ouchy, west of Lausanne. The rocky declivity with which it descends towards the lake is in many places between Vevay and Lausanne so steep, that the road between those two towns is cut in the rock. At Ouchy it recedes from the lake, and runs north-west towards the Jura Mountains; but it does not reach them, being divided from the mountains by a narrow depression, which occurs near the small town of Lasarras. This depression is chiefly covered with swamps, from which a small river, called Noson, runs northwards and joins the Orbe, which falls into the lake of Neuchâtel; whilst the Veiron, another small river originating in the same depression, flows southward to the lake of Neuchâtel. Two hundred years ago an attempt was made to cut a canal through this depression, and thus to unite the lake of Geneva with that of Neuchâtel; but this work was never completed. The high swell just noticed is called Mount Jorat. Though its southern declivity is very steep, it descends gradually towards the north, and its long slopes extend to the distance of 10 miles from the banks of the lake of Neuchâtel. Where it is crossed by the road leading from Lausanne to Moudon, near Chalet Gobet, its upper crest is 1810 feet above the lake of Geneva, or 3039 feet above the sea-level; but farther east, in the vicinity of the Alps, it rises to 3800 feet. The whole country between the lakes of Geneva and Neuchâtel, with the exception of the steep descent towards the lake of Geneva, presents a succession of round-backed hills or short ranges, sloping very gradually on all sides, and interspersed with open valleys, which frequently enlarge to small plains. The eminences decrease in elevation as they approach the lake of Neuchâtel, and the country on its banks can only be called undulating. There are few tracts which cannot be cultivated, and they are of small extent. The soil is rather fruitful, though not distinguished by fertility, and the whole country is either covered with corn-fields, on which maize, wheat, barley, &c. are grown, or with orchards or vineyards. The vineyards are very extensive on the lake of Geneva, and yield some good wine. The plantations of chestnut-trees are extensive, and almond-trees and fig-trees abound.

Another swell of high ground traverses the plain in a different direction. It is connected with the Jorat Mountains south-east of Moudon, and extends thence in a north-east by east direction to the town of Freyburg. From Freyburg it passes south of the town of Bern, where it declines more to the east, terminating at Mount Napf, which stands on the north-western border of the mountain-region. This swell rises about 1000 feet above its base, which may be 1500 feet above the sea-level: it contains a few summits; one of the highest of them is Mount Bütschel, south of the town of Bern, which rises to 3450 feet above the sea-level. On the spacious and level summit, and the gentle declivities of this swell, pastures and cultivated fields succeed one another, with orchards and vineyards. The beautiful and rich valley of the river Emmen extends as far north as the vicinity of the town of Burgdorf, which is within this swell.

The remainder of the plain has generally an undulating surface, the eminences rarely rising into hills, and most of the slopes being gentle. There occur also some level tracts, the largest of which is the low country between the lakes of Neuchâtel, Morat, and Bienne, which, when the rains have been very abundant, is overflowed. Within this portion of the plain only a few isolated summits occur, which rise from 1000 to 2000 feet above their base. The highest of them is the Bäntiger, north-east of Bern, which rises to 3438 feet. The soil is of moderate fertility, but when well cultivated it rewards the labour. It is mostly under the plough, and produces all kinds of grain, as well as hemp and flax. Vineyards are not extensive, and the wine is not of good quality; but other fruits, especially apples, pears, plums, walnuts, and cherries, are very abundant; and from the cherries kirschwasser is made. At the north-eastern extremity of this country is the Lindenberg, a moderate swell, about 500 feet above its base, which is remarkable for the horizontal line in which its crest runs for 20 miles, between Roth and Lenzburg: not an eminence is observed on it.

The principal river of the plain is the Aar [Rhine, vol. xix., p. 459], which here receives the Saane, Thiele or Ziel, Emmen, and Reuss. None of these affluents of the Aar are navigable, except the Thiele, which is navigated by river-barges and steam-boats to the lakes of Bienne and Neuchâtel. The largest lakes are those of Geneva [Leman, Lake, vol. xiii., p. 417], of Neuchâtel [Neuchatel, vol. xvi., p. 164], of Morat, and Bienne. The lake of Morat is nearly five miles long, and nearly one and a half wide: it receives the waters of the river Broye, which rises on Mount Jorat, and, after a course of 20 miles discharges its waters into the lake of Neuchâtel by a channel also called the Broye. As to the lake of Bienne, see Bienne, vol. iv., p. 390. These lakes abound in fish. In the north-eastern districts of the plain are several smaller lakes: the largest of them is that of Sempach, north-west of Luzern, which is about five miles long, but in no part more than a mile wide. It is 1695 feet above the sea-level, and 256 feet above the lake of Luzern, which shows that the country has a considerable rise between the two lakes.

The Fourth region of Switzerland is the Jura Mountains, which occupy the north-west part of the country, being divided from the plain by the line above mentioned, and extending along the boundary of France. This elevated region occupies about 150 miles in length, with a width of about 30 miles. Between Besançon in France and the lake of Neuchâtel it is 35 miles wide. It begins on the south on the banks of the Rhône, opposite Mount Vuache in Savoy, and at the place where the river runs underground, called Porte du Rhône: it extends thence in a north-east direction until it terminates on the banks of the rivers Aar and Rhine, where its branches fill up the peninsula formed by the lower course of the Aar and the Rhine from its confluence with that river to its great bend between Solothurn and Basel. About half of this region lies within France, where it occupies about one-half of the departments of Ain and Jura, and three-fourths of that of the Doubs. In Switzerland it extends over the western districts of the canton of Vaud, the whole area of that of Neuchâtel, the north-western districts of Bern, the greater parts of Solothurn and Basel, and a small portion of Aargau. Its south-eastern edge, which borders on the plain of Switzerland, runs in a slightly curved line. It is, properly speaking, an elevated table-land, whose surface declines gradually from east to west. It rises from the plain of Switzerland with a steep ascent to an elevation of 3000 feet, and at this elevation it is traversed in its length by many low chains, which divide the whole surface of the region into numerous longitudinal valleys. Many of these valleys are connected with one another by depressions, while others are entirely surrounded by hills, and the water which collects in them escapes by natural tunnels. On the low and narrow ridges which divide these valleys a few summits rise from 600 to 2000 feet above their base. The southern part of the table-land, which is entirely within France, is the most elevated, and its mean elevation above the sea may exceed 3500 feet. Here are the mountains called Reculet (5628 feet), Pré des Marmiers (5650 feet), and the Grands Colombiers (5565), which are the highest summits of the Jura Mountains. Within Switzerland are Mount Dole (5515 feet), and Mont Tendre (5522 feet), which lie west and north-west of the lake of Geneva, and Mont Chasseron (5223 feet), west of the lake of Neuchâtel, and Mont Chasseral (5211 feet), north-west of the lake of Bienne. Mont Terrible, which stands close to the great bend of the Doubs, and on the north-west edge of the Jura Mountains, attains only 2558 feet above the sea-level. But in the southern and central part of this region are several other summits which rise between 4000 and 5000 feet. This region, as far as it is within Switzerland, may be divided into three sections, the Southern, Central, and Northern districts.

The Southern district extends to the southern extremity of the lake of Neuchâtel, and forms a part of the canton of Vaud. In these parts the Jura Mountains do not rise abruptly from the plain, but a lower range, a kind of terrace of small width, lies between them, which is called La Côte, and in its southern parts is covered with vineyards, where the wine known under the name of La Côte is grown, between Geneva and Morges. Farther north are plantations of mulberry-trees for the use of silkworms. There are also numerous orchards, and in some parts the slopes are wooded. In the mountain-region itself there are two large and several smaller valleys. The two larger valleys are those of Joux and of Valorbe, and they may be considered as one valley, thirty miles long and about two miles wide. This valley is divided into two valleys by the summit called Dent de Vaulion, which rises to 4831 feet above the sea-level. The valley of Joux, or that south of this summit, is 3375 feet above the level of the sea. It is drained by the river Orbe, which in approaching the Dent de Vaulion enters the lake of Joux, which is five miles long and more than a mile wide. After leaving this lake the river forms a small lake, that of Brenet, on flowing from which it is precipitated into an opening at the foot of the Dent de Vaulion, from which it issues as a considerable stream on the north side of the mountain. Here begins the Valorbe, which extends to the town of Orbe, where the river leaves the mountains, at the foot of which it flows through the plain to its mouth, which is at the southern extremity of the lake of Neuchâtel. In the valley of Joux, which is more than 700 feet higher than Valorbe, only barley and oats are grown, and there are no trees, except a forest of fir-trees, in the southern portion of the valley, which belongs to France. The greater part of the valley is used as pasture and meadow ground. The valley called Valorbe contains fine forest-trees, and is generally well cultivated, except on the slopes of the surrounding mountains, which produce grass: all kinds of fruit-trees abound.

The central district of the Jura Mountains extends from the parallel of the southern extremity of the lake of Neuchâtel to the northern extremity of the lake of Bienne. It consists of numerous valleys, which are divided from one another by low ridges. The waters from several of them have apparently no outlet, but they sink into openings in the ground, by which they probably reach some watercourse that flows into one of the two lakes at the eastern base of the mountains. The whole region is destitute of trees, with the exception of the lower portion of the eastern slope, where there are extensive vineyards which produce good wine, and orchards. There are also mulberry-trees and some silk is cultivated. Here also, and in three large valleys which open towards the lakes, every kind of gra[illegible] a grown, and agriculture is carried to a high degree go and tion. But the mountain-region itself, with itrriencing a ridges, is in its natural state only covelook out for coal. though the soil is dry, the pastures are ritons of Freyburg, herds of cattle. The inhabitants of th, mostly of inferior of the southern, are noted for their greer cantons. dustry and their talent for invention. Ihe supply of sum- advantages, among which is the long wirhe greater part of

Switzerland. The pasture-land of the Jura Mountains is inferior to that of the Alps. A large proportion of land in the valleys and plains is kept as grass-fields, and mowed for winter fodder, an essential and rather dear article in a country so largely stocked with cattle. In the lowland cantons the grass-land is much better attended to, with respect to manuring, irrigating, and renewing than in the highlands. In the two cantons of Vaud and Neuchâtel the cultivation of the vine obtains the preference over the other branches of agriculture. In the mountain cantons the old grass-lands are never broken up.

Iron is found in the Jura; and there are furnaces and iron-works of some importance in the cantons of Vaud, Bern, Soleure, Basle, and Aargau, and likewise in Graubündten. In the Grisons there are mines of lead, zinc, and galena. Salt-springs abound in Switzerland, but they are generally neglected, except those of Bex in the canton of Vaud. [BEX.] Switzerland imports much salt from Germany and other countries.

The mineral-waters of Leuk in the Valais, of Baden and Schinznach in the Aargau, of Gurnighel near Bern, of Lavez, in the canton of Vaud, of Pfeffers, in the canton of St. Gall, and St. Moriz, in Graübundten, are all well known and much frequented by invalids during the summer season.

The lakes and rivers of Switzerland abound with fish, especially trout of various kinds. In the lakes of Geneva and Constance there are trout that weigh from 30 to 60 lbs. The salmon is found in the Rhine, the Aar, and the lake of Zürich; tench, carp, perch, eels, and crabs are found in most Swiss waters.

The game consists chiefly of chamois, hares, marmots, and partridges. Bears and wolves are hunted in the Alps and the Jura. Birds of prey of large dimensions are common in the mountains.

Trade and Manufactures.—Switzerland has been, at least in part, a manufacturing country for centuries. Manufactories of woollen and linen cloths existed at St. Gall and in the canton of Appenzell in the thirteenth century. At the same epoch Zürich manufactured and exported large quantities of silks and woollens. Silks, woollens, and linens were made at Basel in the sixteenth century; and Geneva manufactured at the same time silks, lace, jewellery, and cutlery. In the seventeenth century clocks and watches began to be manufactured in the mountains of Neuchâtel. These and other like branches of industry have had their vicissitudes: some have failed in certain localities and others have sprung up in their place; but Switzerland has never ceased to be a manufacturing country to a considerable extent ever since the thirteenth century, and the general amount of its manufacturing industry has greatly increased within the last century. About the middle of the eighteenth century cotton was introduced into the Swiss manufactories. In 1800 the first spinning-machine was established at St. Gall, and improved methods in weaving, bleaching, and dressing of cloth were soon after introduced. Notwithstanding spinning-machinery has been multiplied and improved in Switzerland, it appears that the cantons of Appenzell and St. Gall alone still take from England annually about one million pounds weight of cotton-yarns. The principal branches of Swiss manufacture at present are as follows:—

In the canton of Zürich the manufacture of silks, florentines, gros-de-Naples, taffetas, serges, levantines, silk handkerchiefs, and ribbons, gives employment to between 12,000 and 13,000 people. The total annual produce of the silk-manufacture of Zürich is reckoned at about seven millions and a half of florins, or about 600,000*l.* sterling. 'Rarely are there a number of looms at work collectively; almost all are to be found singly, or two together, seldom even three or four: in the common apartment of the family of the country-people one or two members of the family may be seen weaving and carrying on at the same time their household occupations, sometimes working in their gardens, &c. Other members of the family, even the children when released from school, assist in the winding of the silk, and it is this union of manufacturing with agricultural pursuits which has combined to promote the trade.' (Dr. Bowring's *Report on the Commerce and Manufactures of Switzerland.*) The cotton-manufactures of Zürich employ about 5000 spinners, besides 4000 persons en-
lake of Zürich. Th ades connected with the cotton-manufac-
river issuing from ,000 pieces of cotton are manufactured yearly. There are nineteen printing establishments, which employ about 1000 workmen, and print about 100,000 pieces of cloth yearly. Zürich and Winterthur and the villages along the banks of the lake are the principal seats of manufacturing industry. The other manufactures of Zürich, such as woollens and linens, which were once important, are now reduced to insignificance.

The canton of St. Gall, and that of Appenzell, which is enclosed by the former, constitute another important manufacturing district, especially of cotton goods. Appenzell alone has about 10,000 looms, and it is calculated that about 10,000 pieces of cloth of 16 ells in length are manufactured every week. Part of the workman's time is employed in household and field occupations, as at Zürich. Trogen and Herisau, in the Protestant rhode, or division, of Appenzell, are the chief manufacturing places. They make some very fine muslins, both plain and embroidered. St. Gall also manufactures muslins and prints in considerable quantities. The other manufactures of St. Gall are leather, linen, glass, and goldsmith-ware. A considerable foreign trade is carried on with Italy and Germany, and St. Gall has several substantial mercantile houses.

The city of Basel forms another emporium of trade and manufactures, principally of silk ribbons, silk thread, taffetas, and satins. There are from 3500 to 4000 looms in activity. The annual exportation of ribbons from Basel amounts to about ten million of francs, of which one-half is said to go to the United States, and the rest to Germany, Holland, Sweden, and other countries. The other branches of manufacture at Basel are leather, paper, and tobacco. Basel carries on considerable business with foreign countries, and has several wealthy banking firms and capitalists.

Schaffhausen has a manufactory of steel and files, which is in great repute; one of cotton-spinning, and one of cotton-prints. Schaffhausen is also a place of transit and depôt of Swiss goods exported to Germany, and German goods imported into Switzerland. The principal goods imported are Suabian woollen-stuffs and hides, salt from Würtemberg, cloths from Bohemia and Saxony, and Nürnberg manufactures. The Swiss send to Germany cheese, silk and cotton goods, and also wine, and kirschwasser; but the trade with Germany is now much checked by the heavy duties imposed by the commercial league.

At the opposite extremity of Switzerland, Geneva is a great mart of trade and industry. The manufactures of Geneva consist chiefly of watches, jewellery, and musical boxes. About 100,000 watches, mostly gold watches, are annually manufactured at Geneva. There are about 270 chefs d'atelier, or master manufacturers, and 1330 workmen employed in watch-making. In the jewellery manufacture there are 107 chefs d'atelier and 660 workmen; in works called 'mécanique,' such as musical boxes and musical watches, 53 chefs d'atelier, and 164 workmen. (Lereschc, *Dictionnaire Géographique et Statistique de la Suisse.*) The Geneva watches and musical-boxes are sold all over Europe, the Levant, America, and the north of Africa; the jewellery is sold mostly in Italy. From 8000 to 10,000 watches, of the average price of 10*l.* sterling each, are annually introduced, and most of them smuggled, into England. The jewellery sent from Geneva to England amounts to about 60,000*l.* annually. 'The watches of English manufacture do not come into competition with those of Swiss production, which are used for different purposes, and by a different class of persons. Notwithstanding all the risks and charges, the sale of Swiss watches is large, and it has not really injured the English watch-making trade. The English watches are far more solid in construction, fitter for service, and especially in countries where no good watchmakers are to be found, as the Swiss watches require delicate treatment. English watches therefore are sold to the purchaser who can pay a high price: the Swiss watches supply the classes to whom a costly watch is inaccessible.' (Dr. Bowring's *Report.*)

The other branches of manufacture at Geneva are cabinet-work, sadlery, lithography and engraving, cutlery, fire-arms, enamels, &c. There are at Geneva many respectable mercantile houses, banking-houses, bill and stock brokers, and a number of capitalists, who invest their funds either in foreign stocks, or place them in mercantile houses, or employ them in discounting bills of exchange.

The manufactures of the canton of Neuchâtel are: 1. the printing of cottons, the cloth being furnished chiefly from the Zürich looms. About 80,000 pieces are printed

yearly, and are exported chiefly to Prussia, Holland, Belgium, and Italy. 2. Lace-making, which once occupied a great proportion of the female sex, but which has greatly declined. 3. Watch-making, which has greatly increased within the present century. From 100,000 to 120,000 watches are yearly manufactured in the canton of Neuchâtel, in the districts of Locle and La Chaux de Fond, among the highlands of the Jura. About one-third of the watches are gold, and the rest silver; the silver watches as low as from twenty to twenty-five francs apiece. The principal exports are to the United States of North America, to the Levant, to Prussia and other states of North Germany, and to Russia. Since the reduction of the duties, Neuchâtel and Geneva watches are introduced into France through the custom-house; formerly they were smuggled in great quantities. It is calculated that from 18,000 to 20,000 persons live by the manufactory of watches in the canton of Neuchâtel.

The canton of Thurgau has from 3000 to 3500 looms employed in weaving cotton-goods, several spinning-factories, several factories for cotton-printing in the neighbourhood of Frauenfeld, and also factories of linen, which branch however has much declined.

The small canton of Glarus manufactures a considerable quantity of cotton-goods, prints, and muslins.

Aargau manufactures cotton-cloth of all descriptions, white and coloured hankerchiefs, prints, stockings, and other hosiery, also silks and ribbons, and silks mixed with wool and cotton, linens, and cutlery.

The rest of the cantons of Switzerland cannot be considered as manufacturing countries, although most of them have some manufactures, but none of great importance, and only to supply their own wants. Bern manufactures good gunpowder. In the northern part of the canton, which formerly was subject to the bishop of Basle, there are iron-works and furnaces, and manufactories of arms. Silks are made at Gersau in the canton of Schwyz. The canton of Vaud has some iron-works, and also manufactories of cutlery, pottery, leather, &c. Soleure has furnaces and iron-works, glass-works, and manufactories of cottons and cotton-prints. Olten and Ballstall are the principal manufacturing places in the canton of Soleure.

The trade of Switzerland with foreign countries is founded upon the principle of free-trade and free-transit, though the surrounding countries, France, Austria, and the German league, do not act towards Switzerland upon the reciprocity system. But the manufactures of Switzerland have found a vent in distant countries, by passing through Germany and the Sardinian States to the various harbours of Holland or the Mediterranean. The French tariff is perhaps the hardest upon Swiss manufactures.

In the interior, between canton and canton, there are tolls and turnpikes which exact a very small duty, levied according to weight, on merchandise. There are also federal duties on imports at certain points of the frontiers, on the great lines leading into Switzerland, such as Basle, but they are neither high nor accompanied by inquisitorial examination.

Moral Character of the Inhabitants.—Switzerland is a country of various races, and this circumstance, as well as the difference of situation and climate, and of institutions, language, and religion, contribute to give distinct moral features to the various populations. Generally speaking, the western Swiss bear a certain affinity to their French neighbours of Burgundy and Franche Comté, being, like them, descended in great measure from the Burgundians, whose kingdom extended on both sides of the Jura; while the eastern and northern Swiss resemble their German neighbours of Suabia and Tyrol. The inhabitants of the central Alpine cantons have peculiar features, physical as well as moral, and they have remained more unmixed from foreign irruptions and immigrations than the rest. The inhabitant of the Alps, says J. Olivier, a Swiss contemporary writer, is strongly attached to his native locality, firm and tenacious even unto obstinacy, proud and single-minded; his feelings are deep and energetic; he is prone to enthusiasm, and to a kind of poetical abstraction. The inhabitants of the region of the Jura are more civilised, more developed, more industrious, more progressive. In politics, liberty in the Jura is of the modern kind, the offspring of reasoning and of speculation; in the Alps it is a natural and individual sentiment. The pastoral population of the Waldstätter have been free from time immemorial; they were free whilst the rest of Switzerland was cultivated by serfs. The plateau or table-land of Switzerland which lies between the two mountain-regions is the country of agriculture; it also contains the largest and wealthiest towns; it enjoys a greater degree of ease and comfort, and the inhabitants are more fond of material enjoyment; they are less shrewd and ingenious, more satisfied, and less anxious about lucre and accumulating wealth than the mountaineers of either the Jura or the Alps. The inhabitants of the mountain cantons are fond of money, which is scarce in their country, and travellers have complained of their grasping disposition, especially the innkeepers, muleteers, and guides. Gross cases of imposition, accompanied by rudeness, occur now and then, for which there is little chance of redress, as the local magistrates are connected with the innkeepers, or are innkeepers themselves, and the local courts in the small democracies of the Alps are not very scrupulous or just.

The inhabitants of the canton of Ticino and of the southern parts of Graubündten resemble in several respects their Lombard neighbours. The Protestant cantons, and even those districts of mixed cantons which are inhabited by Protestants, are generally speaking more industrious, more refined, more advanced in instruction than their Roman Catholic neighbours. This is an old distinction, which still exists: it has been repeatedly noticed by foreign as well as native writers; for whatever may be the cause or causes of it, the fact is undeniable, and it attracts the notice even of the passing traveller. It cannot be merely owing to the difference of soil and climate, as Freyburg is as much favoured by nature as its neighbours Bern and Vaud, and yet the contrast is striking in crossing the borders. Franscini, of the canton of Ticino, himself a Roman Catholic and a priest, admits the fact; and he attributes it to various causes: 1st, the much greater number of clerical persons who are supported by the people in the Roman Catholic cantons. The Protestants have one incumbent for each parish, and few coadjutors or curates. The Roman Catholic parishes are generally smaller, and therefore the incumbents are more numerous, besides a number of coadjutors and of chaplains attached to particular chapels, for several priests say mass in the same church: there are also the chapters of collegiate churches; and lastly, many convents, especially of mendicants, whose inmates are supported entirely by public contributions. In Protestant Switzerland there is upon an average one clergyman for every 700 inhabitants; in Roman Catholic Switzerland one for every 150. The Protestant population of Switzerland, which is three-fifths of the whole, comprises between 1600 and 1700 ecclesiastics; whilst the Roman Catholic two-fifths comprise 5200, besides about 2000 nuns. In several Roman Catholic cantons, especially the mountain cantons, the parish priest is poorly paid, and he adds to his pittance by fees and other contributions, which he exacts from his parishioners, sometimes, says Franscini, by working on their credulity. 2nd, The numerous convents, about sixty in all, several of which have large landed property, which, according to Franscini and Lersche, is ill administered and ill cultivated. The wealthiest convents in Switzerland are those of Einsiedlen in the canton of Schwyz, Muri and Wettingen in Aargau, and St. Urban in the canton of Luzern. The government of Aargau has lately attempted some economical reforms in the convents, especially those of Muri and Wettingen, which have each a property of about two millions and a half of Swiss livres, or about 150,000 pounds sterling, but it has met with great opposition, and the affair has been lately brought before the federal diet. 3. Education is, according to Franscini's statement, more neglected by the Roman Catholics than by the Protestants, especially in those branches which are connected with commerce and industry. 4. The Roman Catholics spend much money in building and ornamenting churches, having several altars or chapels in each of them, and a quantity of costly utensils, clerical dress, and appendages and votive offerings. Many of them also pay for dispensation from fasting during Lent, &c. 5. The Roman Catholics spend much time in church; many of them attend mass or vespers, or some other service every day: there are also processions, pilgrimages, and other practices, which, though not expressly commanded by their religion, are recommended as meritorious. 6. The Protestants abstain from work only on Sundays, but the Roman Catholics have between 20 and 25 other holidays in the course of the year, during which, not only do they not work, but their cattle and their mills remain inactive. Franscini, by multi-

plying these holidays by the number of persons able to work, calculates the total loss at about eight million days of labour in the year. At the same time these unproductive days occasion an additional expenditure, or rather waste, in eating and drinking; so that the loss becomes double. These abuses, Franscini observes in conclusion, do not belong to the essentials of religion: they are extraneous matters of discipline, which might be reformed. (Franscini, *Statistica della Svizzera*, lib. viii., c. 1 and 3.)

Notwithstanding the varieties of institutions, habits, and manners, the political life of the Swiss as an independent confederation of republican states for more than five centuries has given to the whole something of a national character, which distinguishes them from the subjects of the great European states which surround them. The Swiss in general are fond of their country, and feel proud of being Swiss. We find amongst all, both in the mountains and the plains, a frank bold bearing and gait, and freedom of sentiments which proclaim them as citizens of a free country. There is also a love of domestic comfort, propriety, and of the decencies of life, among all classes, and in a greater degree than is found among the corresponding classes in France or Italy. The difference in the appearance of the country and the houses, the superior cleanliness, tidiness, and care forcibly strike the traveller who crosses the Jura or the Alps into Switzerland. The feeling of order, the habit of reasoning and discriminating, the steady, slow perseverance, the disposition to grave and religious thoughts, the shrewdness and humour, distinct from cunning and wit, all which are qualities generally characteristic of the Teutonic nations, in great measure belong also to the Swiss, who are for the most part descended from Teutonic races. The Swiss are, generally speaking, warm-hearted and hospitable; they are kind to strangers, and their country can boast of having been in all times a land of refuge for the unfortunate and the persecuted. The Italian Protestants in the sixteenth century, the Valdenses, the French Protestants who were driven out of their country by the intolerance of Louis XIV. in the seventeenth—all found an hospitable reception in Switzerland. The Roman Catholic emigrants, priests and laymen, who escaped from France at the time of the great Revolution, found sympathy and assistance from the Swiss, both Roman Catholic and Protestant. In later times political emigrants of various countries, both in the time of Napoleon and since the restoration, have taken refuge in Switzerland, not without the risk on the part of that country of being involved in hostilities with powerful neighbouring states on account of the imprudent and guilty conduct of several of the refugees. In our own times subscriptions to the amount of nearly 800,000 francs were collected in Switzerland for the cause of Greek emancipation.

The Swiss have been always inclined to the military profession, and their political institutions, which require every young man to be drilled and to serve in the militia for a certain period, strengthen this propensity. Most cantons of Switzerland have for centuries furnished, and some still continue to furnish, regiments for the service of foreign powers. This practice has been much animadverted upon, especially of late years, by men who have not made a sufficient discrimination between encouraging foreign enlistment and merely tolerating it as an unavoidable evil. Much declamation has been mixed up with the subject, about Swiss republicans being mercenaries in the service of foreign despots, without considering that men who enlist for money trouble themselves little about forms of government, their motive being either to get a better living than they have at home, or a love of adventure and a wish to see foreign lands. As long as there are powers that will pay foreigners who enlist in their service, there will be people, not only in Switzerland, but in other countries too, ready to serve them. Switzerland is not the only country in which the practice of enlisting volunteers for the service of foreign states has been in use; the difference is, that in Switzerland several of the cantonal governments were parties to the bargain, and derived a profit from it, whilst other European governments have either forbidden the practice, without however succeeding in preventing it altogether, or have connived at it. In a country like Switzerland, from whence hundreds emigrate every year to America and other distant countries, foreign enlistment is not perhaps so very objectionable a practice. It has been said by the apologists of the Swiss system of foreign recruiting, that the interference of the cantonal governments in a practice which they could not possibly have prevented (for it is well known that in spite of formal prohibitions, in the times of Louis XII. and Francis I., thousands of Swiss went to join the French armies in Italy, whilst as many went to serve the opposite party), was in reality beneficial to the men, inasmuch as it secured to them the fulfilment of their agreement, whilst the cantons retained the right of recalling their respective regiments in case of an emergency at home, or in case of the agreement not being fulfilled. On the other hand, there has been considerable misconception abroad upon this subject: the cantonal governments have been represented as selling their countrymen like cattle, while the truth is that the men were not sold, but enlisted of their own accord for a certain period, and they received the bounty money. Still the practice of foreign recruiting was formerly very extensive, and was too much encouraged by the cantonal governments not to be liable to abuse and corruption.

At present, most cantons have forbidden foreign recruiting, and the Swiss have regular regiments only in the service of the pope and the king of Naples. Formerly they had about 15,000 men in the service of the kings of France, about half that number in the service of Holland, besides several regiments in Spain, in Piedmont, and at Naples. Those cantons from which the respective regiments were drawn received an annual subsidy from the state for whose service they were recruited. The regiments were raised by the colonels, who were proprietors of their respective corps. The agreement of each regiment was for a certain number of years, after which the officers retired on full pay for the rest of their lives. The fidelity of the Swiss soldiers to their colours was proved in the two French revolutions of our own times.

According to the present internal military system of Switzerland, every able-bodied man from the age of eighteen to fifty is considered as belonging to the militia of his canton, and as liable to be called out by his cantonal government. In each canton however the militia is divided into three classes: 1. The federal contingent, which is the number of soldiers which, by the federal compact, each canton is bound to furnish in proportion to its population when called upon by the federal government, in case of either foreign war or internal disturbance. The contingent consists of the youngest and ablest, and generally unmarried men, chiefly from the age of twenty to twenty-eight. In every canton the contingent is called out once a year for a week or a fortnight for field-exercise. In some cantons the men are encamped during that time, and perform regular camp duty. The contingent is formed into battalions of infantry, with a proportion of artillerymen, waggon train, and pioneers. When the contingent is called out, it receives regular pay. The united contingents of all the cantons amount to about 33,750 men, 27,000 of which are infantry of the line; 2000 carabineers or riflemen, about 3000 artillery and waggon-train, 730 cavalry, and the rest pioneers, pontoon-men, &c. The cavalry is small, because it has been supposed that on a ground like that of the greater part of Switzerland there is not much occasion or opportunity for its use. 2. The reserve consists of an equal number of men, distributed nearly in the same proportions as in the contingent. It consists of men who have done their duty for several years in the contingent, and it is liable to be called out in cases of urgency, on the summons of the federal government. As a last resource for the defence of the country, the *levée en masse*, called 'landsturm,' includes all men who are able to bear arms. A small proportion of the contingent are called upon by turns to do local duty in their respective canton as guards, patroles, &c. Several cantons have also a small body of gendarmes, or armed policemen, regularly enlisted and paid. The men, both of the contingent and the reserve, are mostly armed and accoutred at their own expense, or, if too poor, are supplied with arms by their respective cantons.

There is for all Switzerland a 'federal military commission' appointed by the diet, and renewed every three years: it consists of a president and four members, who are field-officers. Their duty is to inspect the contingent and reserve of the various cantons by turns, as well as the military schools existing in several cantons, and make their reports to the diet on their condition and efficiency, and to suggest improvements. There is a school for the artillery and engineers of the whole confederation at Thun, in the canton of Bern, in which about 40 officers and 180 non-commissioned officers and men are instructed in the scientific part of their

profession. The expenses are defrayed by the federal fund. This fund is supplied out of a small duty levied by the federal government on certain imports, and from other sources. Every canton is also bound to pay, in proportion to its population and wealth, a quota in money for the ordinary federal expenditure, and for the support of the troops when called into active service by the federal government.

Education and Instruction.—Elementary instruction has been greatly ameliorated of late years in many of the Swiss cantons. Those which have made most improvement in this respect are Zürich, Basle, Schaffhausen, Neuchâtel, Geneva, and Vaud, in which the number of pupils of the elementary or communal schools forms about one-sixth of the whole population. The cantons which are most behind in this respect are Uri, Schwyz, Unterwalden, Appenzell interior, the Grisons, Ticino, and the Valais. Many parishes have no school: the parish priest gives some sort of instruction to the children, but it is neither regular nor sufficient, and the number of illiterate persons is very great.

At Basle, Geneva, and other towns, Sunday-schools have been established for the children of the poor. At Bern and other places are schools for the artisans who are in want of useful information in their respective trades, who cannot attend the day-schools.

The cantons of Vaud, Aargau, Schaffhausen, Zürich, Luzern, Soleure, Grisons, and some others, have schools for making schoolmasters. In most places, especially in the country communes, the schoolmasters are miserably paid. The best paid are perhaps those of the cantons of Zürich, Aargau, and Vaud, but the utmost which they receive as salary seems to be 250 Swiss livres, or 15 pounds sterling, per annum.

The secondary or gymnasial instruction is given in the gymnasia, which exist in most of the head towns of cantons, besides secondary or grammar schools in most of the other towns. There is however a great difference among them as to the method of instruction. In some the old system is followed: Latin, rhetoric, and little more, are taught. In others, such as Zürich, Basle, Bern, Vaud, Geneva, Neuchâtel, Aargau, Appenzell exterior, Schaffhausen, the secondary schools are divided into literary schools, for those who are intended for the higher walks of life, and not literary, or 'Real -chulen,' and schools of arts, for the others. Modern languages, drawing, history, geography, natural history, rural economy, and music are taught in most of them. The Grisons have a good 'cantonal school,' or lyceum, at Coire, but some prejudice, says Franscini, exists against it among the Roman Catholic part of the population. Among private institutions that of Fellenberg, at Hofwyl, holds the first rank. [HOFWYL.]

Physical education, which is generally sadly neglected in all schools, a neglect the effects of which are felt through after-life, and mar the prospects of many a man, has begun to be attended to in some of the Swiss cantons. Gymnastic exercises, riding, and swimming, are taught in the schools of Bern, St. Gall, Glarus, and some others. Pedestrian excursions in the Alps are a frequent pastime in the summer holidays.

With regard to scientific instruction, there are in Switzerland the universities of Basle and Zürich, and the academies of Geneva, Bern, and Lausanne, in which degrees of divinity, and law, and arts are granted.

There are public libraries at Zürich, Bern, Basle, Soleure, Luzern, St. Gall, Aarau, Lausanne, and Geneva. Subscription libraries exist in all the Protestant cantons, as well as in that of Luzern. About thirty newspapers and reviews, weekly, monthly, or quarterly, are published in Switzerland.

With regard to the fine arts, Switzerland has had several good painters, especially landscape painters and engravers. The canton of Ticino has produced several distinguished architects and sculptors. Poetry has not been much cultivated; Albert Haller, Solomon Gessner, Bodmer, Lavater, and Salis, are the principal names. In the physical sciences Switzerland can boast of Albert Haller, the Bernouillis, Zimmerman, Tissot, Saussure, Euler, Charles Bonnet, Pictet, De Candolle, and others. Among literary men, properly so called, John Müller, J. J. Rousseau, Sismondi, Bonstetten, Dumont, Madame de Staël, and Father Soave, a native of the canton of Ticino, are well-known names: but Swiss writers are registered in the literary biography of the country in whose language they have written: thus those of Lausanne, Neuchâtel, and Geneva are ranked among French writers; those of the German cantons among the German, and those of the canton Ticino among Italian writers.

The principal associations for learning or scientific purposes are—the Helvetic Society, established in 1763; the Swiss Society of Public Utility, established in 1820; the Helvetic Society of Natural History, established in 1815; the Annual Helvetic Great Concert, the Society of Zoffingen, the Military Society, the Society of Physicians and Surgeons, and some others.

Savings'-banks and insurance societies are now pretty numerous in Switzerland. Hospitals for the infirm poor exist in every town, and some of them are richly endowed. The indigent receive assistance from the funds of the commune to which they belong. It is therefore of great importance for every man to be inscribed as freeman of a commune. There are also numerous local charities and subscriptions for the poor. But there is a class of poor who seem to be considered as outcasts; they are called 'Heimathlosen,' or people without a domicile, and who are rejected by all the cantons: they are people descended from individuals who lost their civil rights in their respective cantons, either in consequence of change of religion, or of misdemeanors for which they were sentenced to banishment, or of illegal marriages, or, lastly, from foreigners settled in Switzerland who did not purchase their citizenship. The stigma thus cast upon their fathers descends upon the children unto the last generation, and they have no right to assistance. These 'Heimathlosen' have become a real plague to Switzerland: they are vagrants, mendicants, hucksters, pilferers, and often robbers, like the gipsies of other countries. The subject has been discussed in the Federal Diet of late years, and several cantons have offered to come to an arrangement for distributing these individuals among the cantons, and restoring them to society.

(Franscini, *Statistica della Svizzera*; Leresche, *Dictionnaire Géographique-Statistique de la Suisse*; Ebel, *Manuel du Voyageur en Suisse*, volume 1st, which contains an ample alphabetical list of the distinguished men that Switzerland has produced, as well as catalogues of writers who have illustrated the various cantons.)

History of Switzerland.—The greater part of modern Switzerland was known in the Roman time by the name of the country of the Helvetii. The Helvetii were a Celtic or Gaulish people, and are mentioned by Cæsar (*Bell. Gall.*, i.) as one of the most warlike and powerful nations of Celtic Gaul. Cæsar says that they were divided into four pagi, or tribes, of which he names two, the pagus Tigurinus, and the Urbigenus or Verbigenus. The modern towns of Zürich and Orbes are supposed to have derived their names from those two pagi. The eastern part of Switzerland, or the present Grisons country, was called Rhætia by the Romans, and was inhabited by a different race of men, who are said to have been descended from the Etruscans.

The Helvetians appear for the first time in history about 110 B.C. The Tigurini having joined the Cimbri in their invasion of Gaul, the Roman consul L. Cassius was sent with an army against them. He met the forces of the Tigurini some say near the Arar or Saone, according to others near the eastern bank of the Leman lake; but he was defeated and killed, together with his legate Piso, and most of his men. The rest made a capitulation, by which they were allowed to return home, after passing under the yoke. (Livy, *Epitome*, 65; Cæsar, *Bell. Gall.*, i., 7, 12.) About half a century later the great body of the Helvetians resolved to migrate with their families into the more fertile regions of Gaul. They burnt their towns and villages, and passed through the country of the Sequani until they reached the Arar, when they were opposed and defeated by Cæsar near Bibracte with great slaughter. [CÆSAR, CAIUS JULIUS.] The survivors, about one-third of the original number, were allowed to return to their country, and were henceforth in the condition of allies and tributaries of Rome. After the total conquest of Gaul, the Romans sent colonies into the country of the Helvetians; but it appears by Tacitus (*Hist.*, i. 67) that the Helvetians retained the right of keeping garrison in some of their own strongholds, and it was the rapacity of the 21st legion, which appropriated to its own use certain moneys destined to pay the Helvetian garrison, that was the first cause of the fatal insurrection of A.D. 69. After the legions of Germany had proclaimed Vitellius, and Cæcina, one of his legates, was marching with a strong force towards Italy, the Helvetians,

who were not yet acquainted with the events at Rome and the murder of Galba, intercepted letters which were written in the name of the legions of Germany to the legions of Pannonia, and which invited the latter to join Vitellius, and they arrested the centurion and his escort as guilty of treason against Galba. Upon this Cæcina, who had just entered the territory of the Helvetii, on his way to Italy, devastated the country, destroyed the Thermæ Helveticæ (modern Baden, in Aargau), and advanced against the main body of the Helvetians, who were in arms, and had chosen a certain Claudius Severus for their leader. At the same time he sent orders to the troops stationed in Rhætia to march upon the rear of the Helvetians, whilst he attacked them in front. The Rhætians had been long subject to Rome, having been conquered by Drusus under Augustus. The Helvetians made no stand against the Roman veterans, and they were massacred without mercy. Some escaped to the mountains, where they were hunted by the Thracian and German auxiliaries, and by bodies of Rhætian light troops, who seem to have willingly turned their arms against their Helvetian neighbours. Those who escaped death were sold as slaves. The town of Aventicum, one of the first in Helvetia, sent messengers to Cæcina, with an offer to surrender; but Cæcina sentenced the principal inhabitants to death, and one Julius Alpinus among the rest. His daughter, Julia Alpinula, a priestess of the goddess Aventia, the local deity, in vain interceded with Cæcina for her father: he was executed, and she does not seem to have long survived her parent. A sepulchral inscription in Latin, found many centuries after among the ruins of Aventicum, revealed this affecting episode. It is to this purport:—'Here I, Julia Alpinula, lie buried, the unhappy offspring of an unhappy father. A priestess of the goddess Aventia, I could not succeed in rescuing my father from a violent death: he was doomed by fate to an untimely end. I have lived twenty-three years.' After this execution, Cæcina marched on towards Italy, referring the people of Aventicum to Vitellius himself, who would pronounce upon their doom. The Helvetian envoys, at the head of whom was one Claudius Cossus, being admitted into the camp of Vitellius, were assailed by the outcries of the soldiers, who demanded the destruction of the whole people. Vitellius himself looked stern and threatening, so that, says Tacitus (*Hist.*, i. 69), it were difficult to say whether the emperor or the soldiers appeared most merciless. Claudius Cossus, a man known for his eloquence, avoided all oratorical attempts at excusing the past; but by the display of his grief and fears and humiliation, he turned the hearts of the soldiers, who now entreated the emperor to forgive the Helvetians, and forgiveness at last was granted. And now the tide of war rolled on towards the plains of Italy, and the Helvetians were left to recover from their calamities. Vespasian, who succeeded Vitellius, had lived when a boy at Aventicum with his father Sabinus, who went thither as a publicanus, and had died there. After Vespasianus became emperor, he remembered Aventicum, and embellished and enlarged that town. Nothing particular occurred in Helvetia till the beginning of the fifth century of our æra. During this long period the Roman language, Roman habits and manners, became prevalent throughout Helvetia, though it is supposed that the more central valleys and Alpine recesses retained a sort of rude independence, as Roman stations have been traced forming a line at the foot of the high Alps, which seem to have extended from the lake of Wallenstadt to that of the Waldstätter, where Luzern now is, and from thence to the highlands of Bern, as if to guard the open country against the irruptions of the mountaineers.

At the breaking up of the Western Empire, the Burgundians, a tribe from the shores of the Baltic, were the first to form a permanent settlement in Western Switzerland, between the Jura, the Leman lake, and the river Aar, and Gebena, or Geneva, became the occasional residence of their kings. [BURGUNDIANS.] Meantime the ALEMANNI, a wilder and more barbarous race than the Burgundians, occupied the banks of the Rhine as far as Eastern Helvetia, until being defeated by Clovis, king of the Franks, at Tolbiacum, near Cologne, A.D. 496, the Franks became masters of the country which the Alemanni had occupied, including a great part of Helvetia. The mountainous district of Rhætia was seized upon by the Goths from Italy, under King Theodoric. The old natives of Helvetia themselves became by turns subjects or serfs of these various masters: being no longer a nation, their very name became obliterated, and they were included in the general appellation of Romans, by which the northern conquerors designated the inhabitants of the countries once subject to Rome. About A.D. 534, the Franks, having overpowered the kingdom of the Burgundians, became masters of all Helvetia, and soon after, at the breaking up of the Gothic kingdom of Italy, they occupied Rhætia also. The Burgundians however, on submitting to the Franks, made conditions for themselves, by which they remained as a distinct nation, retaining their laws, usages, and privileges: the king of the Franks assumed the additional title of king of Burgundy. Several governors, with the title of Duke or President, were appointed by the Merovingian kings of the Franks to govern the various divisions of Helvetia. That part of the country which belonged to the kingdom of Burgundy was called Transjurane Burgundy, the country between the Aar and the Rhine was called Alemannia, and Rhætia formed another distinct division. When the Frankish empire became divided into several kingdoms, Transjurane Burgundy formed part of the kingdom of Orleans, while the rest of Helvetia was attached to the kingdom of Austrasia or of Metz.

Christianity does not seem to have been introduced into Helvetia at a very early period, especially into Eastern Helvetia. The Burgundian part became converted to Christianity soon after the establishment of the Burgundian kingdom, towards the end of the fifth century. The Alemanni of Eastern Helvetia remained much longer in the condition of hunters and shepherds, and in the rude heathenism of their Teutonic ancestors. Towards the beginning of the seventh century, the Irish monk Columbanus, with some of his disciples, came from France to preach the Gospel to the Alemanni of Helvetia, and as they made progress among them, they broke the images of their god Wodan, and built chapels in various parts of the country. This was the origin of the afterwards celebrated churches and abbeys of St. Gall, Disentis, Seckingen, Glarus or St. Hilarius, St. Leodegav of Luzern, and the Münster of Zürich. The pious monks taught also the rude natives to cultivate the soil, to sow corn, to plant the vine, and other useful arts.

Under the weak successors of Charlemagne, the feudal system was thoroughly established in Helvetia, as well as in the other parts of the Frankish monarchy. The counts or governors made themselves hereditary; they became suzerains of their respective districts, of which they were before only magistrates; they took possession of the crown lands, and received the fees of the crown tenants, who became vassals of the local lord. The abbeys and monasteries likewise had their own vassals, many of whom, being originally small proprietors of allodial property, preferred placing themselves under the protection of the church.

When the Frankish empire became divided among the successors of Louis le Débonnaire, A.D. 840, German or Eastern Helvetia fell to the share of Louis of Bavaria, and continued afterwards attached to that part of the German empire called the duchy of Suabia. Burgundian Helvetia fell to the lot of Lotharius, or Lothar, who had the title of emperor and king of Italy. [BOURGOGNE.]

The chief events in the history of Switzerland may be conveniently given in the form of a chronological table:—

A.D. 889. Rudolf, count of Transjurane Burgundy, and son of Conrad, count of Paris, in the midst of the general confusion which prevailed after the deposition of the emperor Charles the Fat, convokes at St. Maurice in the Valais the bishops and lay lords of his government, and is proclaimed by them king of Upper Burgundy; he is also acknowledged as such at a general diet held by the emperor Arnoul at Regensburg, A.D. 890. This new kingdom of Burgundy lasts till 1016, when Rudolf III., called 'Ignavus,' being at variance with his vassals, and having no male issue, makes over his kingdom to the emperor Henry II., and thus all Helvetia becomes annexed to the German empire.

A.D. 1097. Berthold of Zähringen, a great Suabian lord, is made by the emperor Henry IV. 'kastvogt,' or warden, of the town and district of Zürich and other places in Eastern Helvetia, and afterwards his son Conrad of Zäringen is made landgraf of Burgundy.

1152. Frederic of Hohenstauffen appoints Berthold IV. of Zähringen imperial warden of the bishoprics of Lausanne, Geneva, and Sion. The administration of the House of Zäringen over the greater part of Helvetia is wise and prosperous.

1178. Berthold IV. of Zähringen builds Freyburg.

1191. Berthold V. encloses the town of Bern.

1218. Berthold dies without male issue, and the House of Zähringen becomes extinct.

1218. Frederic II. gives imperial charters to the towns of Bern, Soleure, Basel, and Schaffhausen. The principal lords in Helvetia are the counts of Savoy in the south, the counts of Gruyère and of Neuchâtel in the west, and the counts of Toggenburg and Kyburg in the north.

1264. Rudolf of Habsburg by various inheritances becomes one of the most powerful lords in Helvetia.

1273. Rudolf is elected emperor. He favours the independence of the towns. [HABSBURG, THE HOUSE OF.]

1291. Death of Rudolf. His son Albert attacks Bern and Zürich, but is repulsed. He aims at annexing the free towns and districts of Helvetia to the patrimony of the House of Habsburg.

1300. The three Waldstätter, or forest cantons, Schwyz, Uri, and Unterwalden, which had been for ages free communities under the protection of the empire, refuse to acknowledge Albert as their duke. The appeal to their imperial franchises, and demand imperial vogten, or judges, to be sent to them to administer justice, and not ducal ones, as Albert wished.

1304. Albert sends them for imperial vogten two noblemen who were devoted to him, Gessler and Beringar, who commit all kinds of oppression.

1307. Three leading men in the Waldstätter, Werner Stauffacher of Schwyz, Walter Furst of Uri, and Arnold von Melchthal in Unterwalden, conspire to free their country from the tyranny of Albert's vogten. They meet on the Rütli, and take an oath to that effect. William Tell kills Gessler. [TELL, WILLIAM.]

January, 1308. The insurrection breaks out throughout the Waldstätter, Albert's officers are driven away, and their castles razed without effusion of blood.

May, 1308. Albert, whilst preparing to march against the Waldstätter, is murdered by his own nephew John of Habsburg, whose patrimony he detained. [ALBERT I., duke of Austria.]

1315 (November). Leopold, son of Albert, defeated at Morgarten by the people of the Waldstätter, who begin to be called by the general name of Schwyzers.

1315 (December). Federal pact of Brunnen, among the three Waldstätter.

1318. Frederic, duke of Austria, makes a truce with the Waldstätter.

1332. The town of Luzern, which had been subject to the House of Habsburg, joins the confederation of the Waldstätter as the fourth canton.

1339. League of the feudal nobles against Bern. They are defeated at Laupen by the Bernese militia, under Rudolf von Erlach.

1351. Zürich and Glarus join the confederation as the fifth and sixth cantons, and the Zürichers defeat Duke Albert of Austria.

1352. The town of Zug, belonging to the Duke of Austria, being besieged by the Swiss, agrees to join the confederation as the sixth canton, and Bern joins the confederation as the eighth canton. A federal Diet of deputies from the eight cantons is appointed.

1375. Enguerrand de Coucy, a French noble, with an army of adventurers, French and English, called Guglers, invades Switzerland, and is defeated by the Bernese at Frauenbrunnen.

1386. Leopold II. of Austria marches an army against Luzern, and is defeated and killed at Sempach, on the 9th of July.

1388. The Austrians invade Glarus, and are defeated at Näfels.

1389. Truce of twenty years between Austria and the Swiss.

1393. The Sempacher brief, or resolutions concerning military discipline, agreed to in a Diet of the eight cantons held at Sempach.

Meantime Bern and Zürich extend their territories by purchase from the neighbouring lords.

1405. Luzern purchases of the Duke of Austria his seignorial rights over the Entlibuch and other districts.

1403 8. Revolt of the district of Appenzell against the abbot of St. Gall.

1415. Frederic of Austria is excommunicated by the council of Constance, and put under the ban of the empire. The emperor Sigismund invites the Swiss cantons to seize the territories of the House of Austria. They invade the Aargau, which they divide among themselves. Origin of the subject bailiwicks.

1418-22. The people of the Waldstätter invade the Val Levantina and other valleys south of the Alps, which they constitute subject bailiwicks.

1422. The Valais revolts against the lord of Raron, and becomes an independent state allied to the Swiss cantons. About the same time the people of Rhætia revolt against the feudal lords.

1424. The Graubund ('Grey league') formed at Trons gives its name to the whole of Rhætia. [GRAUBUNDTEN.]

1436. Death of the last count of Toggenburg; disputes about his inheritance. Civil war between Zürich and the other cantons.

1444. Siege of Zürich by the confederates. A large force of mercenaries under the Dauphin (afterwards Louis XI.) attack Basel. Battle of St. Jacob. The Dauphin makes peace with the Swiss.

1446. Peace between Zürich and the other cantons.

1452. A fresh war between Austria and the cantons. Austria loses Rapperschwyl, Freyburg, and Thurgau. Duke Sigismund of Austria mortgages to Zürich the town of Winterthur, his last remaining possession in Helvetia.

1457. Mühlhausen, an imperial town of Alsace, forms an alliance with the Swiss.

1475. War between the Swiss cantons and Charles le Téméraire, duke of Burgundy.

1476 (March). Battle of Granson; the Burgundians are defeated.

—— (June). Battle of Morat; total defeat of Charles.

1478. Battle of Giornico, in which the Swiss defeat the troops of Milan.

1481. Dissensions among the cantons. Congress of Stanz. Nicholas von Flue, a pious hermit, restores union. Soleure and Freyburg admitted as cantons. Convention of Stanz, a standing federal law.

1495. The emperor Maximilian I. attempts to enforce the ordinances of the Imperial chamber upon the Swiss as lieges to the empire, and he commands them to furnish a contingent of troops for his war against France. The Swiss refuse, and allege their previous treaties with France.

1499. War between Maximilian and the Swiss. The Imperial troops being defeated near Bregenz, at Frastenz, and other places on the borders of the Tyrol, and also at Dornach near Basel, Maximilian makes peace with the cantons. This was the last war which the Swiss had to sustain for their independence.

1501. Basel and Schaffhausen are received into the confederation as two additional cantons.

1513. Appenzell is also admitted, and completes the number of thirteen cantons composing the Helvetic or Swiss confederation, which existed till the French revolutionary invasion of 1798. The 'socii,' or states associated to the confederation with vote in the diet, were the abbot of St. Gall, and the free cities of St. Gall, Muhlhausen, and Biel, or Bienne. The allies without vote were Geneva, Neuchâtel, the Valais, and the Grisons.

1511-1522. Swiss troops engaged in the wars of Italy as auxiliaries of the Sforza, dukes of Milan, and of the popes, against the French. Battle of Novara won by the Swiss. Battle of Marignano; the Swiss make a good retreat, after sustaining a great loss of men, and making a great slaughter of the French. Battle of La Bicocca, April, 1522, won by the Swiss, who, in concert with the troops of Charles V., drive the French out of Lombardy.

1518. Sale of the indulgences in Switzerland, opposed by Zwingli.

1519. Zwingli, Bullinger, and other Swiss reformers enter into a controversy with the church of Rome. [ZWINGLI.]

1523. Zürich adopts the doctrines of the Reformation.

1528. Bern, after several conferences, issues an edict of reformation consisting of thirteen articles. The towns of St. Gall, Bienne, and Mühlhausen adopt the reformation.

1530. Basel and Schaffhausen proclaim the reformation; Glarus and Appenzell remain divided between the two communions.

Farel preaches the Reformation in Western Switzerland. Neuchâtel adopts his doctrines.

1531. War between the Roman Catholic and the reformed cantons on the subject of the election of a new abbot of St. Gall. The troops of the reformed cantons are de-

feated at Cappel with great loss. Zwingli, who attended as chaplain, is among the killed. Peace of Baar, on the principle of reciprocal non-interference.

1532. Helvetic confession of faith proclaimed by a synod held at Bern.

1533. Farel preaches the Reformation at Geneva.

1535. Bern, as an ally of Geneva, makes war against the duke of Savoy, who claimed supremacy over the latter town.

1536. Bern takes the Pays de Vaud from the duke of Savoy.

1537. John Calvin goes to preach at Geneva.

1538. Calvin and Farel expelled from Geneva. [CALVIN, JOHN.]

1541. Calvin is recalled. The Reformation adopted at Geneva.

1564. Treaty of Lausanne between Bern and Emmanuel Philibert, duke of Savoy. Bern retains the Pays de Vaud.

1602. Charles Emmanuel, duke of Savoy, attempts to surprise Geneva by escalade, and is repulsed with loss.

1603. New treaty between Geneva and Bern on one side, and the duke of Savoy on the other. The duke acknowledges the independence of Geneva.

1618. Beginning of the religious disturbances in the Valtellina, subject to the Grisons.

1620. Massacre of the Protestants in Valtellina.

1621. The Austrians invade the Grisons.

1624. The French come to the assistance of the Grisons, and drive away the Austrians.

1628. The Austrians again invade the Grisons country, and two years after they withdraw.

1639. End of the war of the Grisons.'

1648. The emperor acknowledges, in the treaty of Westphalia, the Swiss Confederation as an independent state in Europe.

1653. Peasants' war in Switzerland; the insurgents are defeated.

1653. Second war of religion in Switzerland. Battle of Willmergen; the Protestants defeated. Peace made.

1582-83. A number of French Protestants persecuted by Louis XIV. take refuge in Switzerland. Most of the Waldenses of Piedmont emigrate to Switzerland, to avoid the persecution of the duke of Savoy.

1710. The district of Toggenburg revolts against the abbot of St. Gall, and is supported by the Reformed Cantons.

1712. Third and last war of religion in Switzerland. The Bernese defeat the troops of Luzern and the Waldstätter at Willmergen. The Roman Catholic cantons sue for peace, which is concluded at Aarau, in August, 1712.

1713-92. A period of peace for Switzerland, with the exception of some local disturbances at Bern, Freyburg, and Geneva.

1792. Massacre of the Swiss guards at Paris. The other Swiss regiments in the French service return home.

1793. The French invade the territory of the bishop of Basel, and annex it to their new republic. They also foment an insurrection at Geneva, which is followed by massacre and confiscation.

1795. The French executive Directory begins to annoy the Swiss Confederation. It encourages the disaffected in the Pays de Vaud against Bern, and the disaffected in general all over Switzerland.

1797. General Bonaparte seizes upon Valtellina, Chiavenna, and Bormio, which were subject to the Grisons, and annexes them to the Cisalpine republic. In the mean time another body of French troops occupies the free town of Bienne, an ally of the Swiss. The agents of the Directory assume an imperious tone towards the Confederation, and demand the expulsion of Mr. Wickham, the English envoy, and of the French emigrants.

1798. Democratic revolution at Basel. Insurrection in the Aargau. The French agents take the insurgents under their protection. Diet held at Aarau, the last of the old Confederation. The French general Ménard, with 15,000 men, enters the Pays de Vaud, and proclaims its independence. An affray takes place between the Bernese and the French outposts, which is followed by a declaration of war by the Directory against Bern. In March the French general Brune attacks the Bernese troops, and is repulsed at Laupen. At the same time another French army attacks the Bernese corps under General Von Erlach, who is defeated. The French enter Bern. Erlach is murdered by his mutinous soldiers. The French seize on all public property at Bern. The French spread all over Switzerland, exact heavy contributions, and change the government of the country. The Forest cantons refuse to submit; the French attack them, and are repulsed at Rothenthurm by Aloys Reding. In September a large French force under Schauenburg invades the district of Nidwalden, or Lower Unterwalden, the inhabitants of which make a desperate resistance, and most of them are massacred, including many women. Their villages are burnt.

1799. The Austrians and Russians enter Switzerland, and drive the French from the central cantons. Massena defeats the Russians at Zürich in September. Suvorov enters Switzerland from Italy by the St. Gothard, but is obliged to retire into the Grisons country. General confusion in Switzerland.

1801. Peace of Luneville; the French evacuate Switzerland. A new federal constitution is proclaimed, but rejected.

1802. Bonaparte, first consul of France, offers his mediation to the Swiss. Conferences at Paris. The Act of Mediation is framed and accepted, constituting Switzerland into nineteen cantons, upon an equal footing, under the protection of France. The Valais, Geneva, Neuchâtel, and other districts are annexed to France.

1813. After the battle of Leipzig the allied troops pass through Switzerland on their way to France. The allied sovereigns refuse to recognise Napoleon's Act of Mediation, and recommend a new federal pact for the future political constitution of Switzerland.

1815. The Allied Powers at the Congress of Vienna acknowledge the independence of Switzerland within its former limits. New confederation of twenty-two sovereign cantons. A federal diet to assemble at least once a year, by turns at Bern, Zürich, and Luzern, to discuss all matters internal and external concerning the general interest of the Confederation. The Diet has power to declare war, make peace, and form alliances with foreign powers, in which cases a majority of three-fourths is required. It also appoints envoys and consuls to foreign states. No canton is allowed to take up arms against another, but all serious differences between one canton and another must be referred to the Diet. In cases of serious disturbances within any one canton, the Diet acts the part of mediator, and prevents violence by means of military occupation if necessary. Each canton has a single vote in the Diet. Measures are carried by a simple majority. The deputies of the respective cantons give their vote according to the instruction which they receive from their constituents. The Diet before closing its session gives directions to the executive council of the canton in which it is assembled for that year, and which is styled the Vorort, or directing canton, to carry into execution its resolutions, and otherwise to provide for the well-being of the confederation during the time that the Diet is not assembled. The Vorort is assisted in its duties by a federal chancery, consisting of a chancellor and a secretary, both of whom are appointed by the Diet. In urgent cases, or simply on the demand of five cantons, the Vorort convokes an extraordinary diet.

1830-31. Most of the larger cantons, whose representation was based upon the principle of property, effect a change by which universal suffrage is established. The proposed change finds a strong opposition in Basel, in consequence of which the town separates itself from the country districts, which form themselves into a separate republic, or half canton. Neuchâtel, after some bloodshed, retains its old constitution under the king of Prussia, who is prince of Neuchâtel. Geneva retains its constitution with a small property qualification for electors. The Forest cantons retain their pure democratic form, with general assemblies of the whole male population. Attempts are made by the radical party to change the federal pact, which are resisted by the majority of the cantons, and especially by the Forest cantons.

1834-36. Disturbances in several parts of Switzerland, caused by the Polish and other political refugees, who attempt to effect revolutions in Savoy and other neighbouring states. Angry diplomatic notes from the foreign powers to the diet, which at last directs the expulsion of those refugees who had been guilty of revolutionary attempts, and other acts endangering the neutrality and tranquillity of Switzerland.

For the history of Switzerland during the middle ages,

Johann Müller's *Geschichte der Schweizerischen Eidgenossenschaft* is the best work. A spirited French translation of it, with valuable notes and a continuation down to our own times, by Professors Monnard of Lausanne and Vulliemin of Basel, has been in course of publication of late years at Paris and Geneva; *Histoire de la Confédération Suisse*, par Jean de Müller, R. G. Blozheim, et J. J. Hottinger, traduite de l'Allemand, et continuée jusqu' à nos jours, par Ch. Monnard et L. Vulliemin. In English a compendious *History of Switzerland*, by A. Vieusseux, has been published by the Society for the Diffusion of Useful Knowledge, 8vo., 1840, with ample references to the original sources.

SWORD-FISH. [XIPHIAS.]

SWORDS. *Greek Swords*. The earliest and fullest information on the subject of the Greek swords is in the poems of Homer. With him the ξίφος, ἄορ, and φάσγανον are synonymous terms: the μάχαιρα is a large knife suspended near the ξίφος (*Il.*, iii. 271) for the purpose of cutting anything; the ξίφος is called μελάνδετον, a term not very satisfactorily explained, and ἀργυρόηλον, or studded with silver, an epithet relating probably to the handle (κώπη), which is said to be of silver: the scabbard, κολεός, in later writers called θήκη (*Od.*, viii. 404), is covered with ivory.

At a later period coins, vases, and other antient monuments, exhibit the form of the Greek sword, which was a short cut-and-thrust blade, diminishing gradually from hilt to point. The manner of using it is very clearly shown on a silver coin of the Locri Opuntii, where a Greek warrior is represented fighting. [LOCRIS.]

Varieties in the form of the blade and handle are occasionally to be met with on vases. (Millin, *Vases Antiques*, pl. 26 and 56.) The θήκη, or scabbard, sometimes terminates in a knob, the μύκης probably of Herodotus (iii. 64). We have only scanty and incidental notices of the sword in Greek writers after the time of Homer. C. Nepos (*Iphicrates*, c. i.) records that that general introduced a longer sword among the Athenian infantry. Xenophon (*De Re Eques.*, xii.) prefers the μάχαιρα to the ξίφος for cavalry, because their position on horseback he considers more favourable for the cutting than thrusting: in this passage μάχαιρα is used synonymously with κοπίς, which leads us to suppose it to have been made at that time only for cutting. In later writers the terms μάχαιρα and ξίφος are used indiscriminately. (Polyb., iii. 114.)

The Greek sword was worn on the left side, suspended by a belt, generally from the shoulder, as in the figure of Meleager on the coins of Ætolia, but occasionally by a girdle round the waist. (Millingen, *Vases Inédites*, xxxvii.) On a vase in Millingen (pl. 23) it is slung more forward, so that the hilt is in the middle of the breast. The material of the Greek blade was generally bronze; in later times, iron.

Roman Swords.—The Roman sword was called 'ensis,' 'gladius,' and 'mucro' (though 'mucro' originally meant the point of the sword only; its edge, 'acies;' its handle, 'capulus;' its scabbard, 'vagina.' Polybius gives an accurate description of the Roman sword used in his day, which had the Iberian short cut-and-thrust blade of finely-tempered steel: this had been substituted for the old Roman sword at the time of the war with Hannibal (lib. vi.; also *Fragm.*, xiv., where he speaks of the admirable temper of the Celtiberian blades). The form of the sword continued from his time till that of the later emperors apparently unchanged. Montfaucon (*Antiquités*, vii.) states that the blades of those on the column of Marcus Aurelius and the arch of Severus are more pointed than on the column of Trajan, and that they became shorter in the time of Constantine the Great and Theodosius. Stewechius (*Comment.* in Vegetium, p. 64, Vesal., 1670) speaks of a larger kind of sword, 'spatha,' under the later emperors. There seems to be no distinction in size or shape between the swords of the infantry and cavalry on Trajan's column and other similar monuments. The Roman sword was worn on the right side. Montfaucon notices three exceptions to this general practice on the arch of Septimius Severus; and the spathæ already mentioned are said to be worn on the left side. The parazonium appears to have been the insigne or sword of office of a military tribune. (Martial, xiv. 29; Raderus, *Comment.*, in loc.; and Pitisc., *Lexicon Antiq. Roman.*)

Other Antient Swords.—For the swords of other nations of antiquity, see Wilkinson's 'Antient Egyptians;' for the ἀκινάκης, or Persian sword, and that of other Eastern people, Leake, 'Athens,' ii., pp. 22-5-6, new edit.; the sculptures at Persepolis, engraved in Sir R. Porter's 'Travels;' and for the swords of the Gauls, Livy, xxii. 46; and more fully, Diodorus, v. 30.

In the British Museum are four antient bronze swords, three of which have cut-and-thrust blades, varying in length from 10 to 25 inches, and in breadth from 1½ to 2 inches. Another, which was purchased at the sale of the late bishop of Lichfield's antiquities, and considered to be Etruscan, is bound with gold wire round the handle, and is about 13 inches long. In Montfaucon (*Antiq.*, vii.) are engravings of three, two of which, as he states, measured a foot and a half (French), and the other 30 inches in length. In the 'Museo Borbonico,' vol. v., pl. xxxix., is an engraving of one having two rings on its scabbard, which is of wood, covered with plates of metal, and studded with brass: a handle of another is finished with an eagle's head. (See the description of the plate, where a passage from Heliodorus, *Æthiopica*, lib. ii., 11, is quoted in illustration.)

Two others are engraved in the same work, iv. 44, one of which has a handle full of holes to receive studs (ἧλα). Compare Virgil's 'Stellatus Iaspide Fulva,' iv. 26.

Varieties, such as the harpa or the sword of the Amazons (Millingen, *Vases Antiques*, vi.), are mythological, and a description of them has consequently no place in an historical account of the sword.

SWORDS, MANUFACTURE OF. So little is known respecting the early history of the manufacture of arms in England, that Hutton and Hunter, in their accounts of the two great seats of the British hardware manufacture, Birmingham and Sheffield, have been compelled to rest upon mere conjecture respecting it. Hunter states that we have no direct information respecting the manufacture of arms at Sheffield, and that all the articles enumerated in the ordinances for the government of the cutlers of Hallamshire, and in the later acts of incorporation, are instruments of peace; yet he considers it probable that weapons of offence were early fabricated by the cutlers of Sheffield, as well as other articles of steel. Holland, in the work referred to at the end of this article, gives a representation of two men grinding a sword-blade, copied from a MS. psalter, written about the time of King Stephen, which is preserved in the library of Trinity College, Cambridge, and which probably represents the usual construction of grinding machinery at that time. The grindstone is mounted upon a horizontal axis, which one man turns by means of a crank, and the sword, which is straight and pointed, is pressed down upon its periphery by the other man, who sits on a beam above the level of the stone, so that his weight may be conveniently thrown upon the sword, to press it firmly against the stone. The same author observes that it appears, from old drawings, that in those early times the blades of swords were placed upon a bench or board, and *furbished*, or polished, by hand, instead of having that operation performed, as at present, upon a wheel covered with leather and emery.

But while there can be no doubt of the extensive manufacture of swords in England at an early period, the blades made in Spain and Italy, and more especially those brought from the East, bore the pre-eminence. The swords of Toledo, which are still celebrated, were sought after on account of their admirable temper, in the time of the Moors, and even under the Romans. It has been supposed that they are indebted for their valuable qualities to some peculiar property in the water of the Tagus, which is used in tempering them; and the author of 'A Year in Spain,' cited by Holland, corroborates this supposition by stating that, in the early period of the French invasion, the manufactory was removed to Seville, where the national junta then was, but it was found that the swords manufactured on the banks of the Guadalquivir were very inferior to those which the same workmen had made at Toledo. In the time of the crusades, and down to a much later period, Milan supplied swords of excellent quality in large numbers; but, celebrated as these and the Spanish blades deservedly were, those from the East were still more highly prized, and enormous sums were often given for them. 'These Oriental sabres,' observes Mr. Holland, 'which are invariably regarded by their possessors as being of great antiquity, are presumed to have been made at Damascus in Syria, Ispahan in Persia, or Cairo in Egypt, at none of which places, if we may credit recent visitors, is the manufacture of steel articles carried on at present.' [But see DAMASCUS, vol. viii., p. 296.] He proceeds to say, 'Of all the sabres how-

ever, the fame of which has reached this country, those of Damascus are by far the most noted, most persons having heard of them, though very few indeed have seen them, and fewer still have been the instances in which the blades themselves have confirmed those strange stories about their temper which are so generally circulated, and received among persons who know but little of the nature of steel. The characteristics ascribed to the real Damascus blades are, extraordinary keenness of edge, great flexibility of substance, a singular grain and fleckiness always observable upon the surface, and a peculiar musky odour given out by any friction of the blade, either by bending or otherwise.' This writer conceives that their quality, undoubtedly excellent as it must be, has been greatly exaggerated, and that the extraordinary powers of execution attributed to Damascus blades are, in a great measure, dependent upon the strength and dexterity of the user. A gentleman who purchased one of these sabres in the East Indies for a thousand piastres, informed Mr. Holland that, although it was very flexible, and bore a fine keen edge, it could not be safely bent to more than 45° from a straight line, and it was not nearly so sharp as a razor; yet, when wielded by a skilful hand, it would cut through a thick roll of sail-cloth without apparent difficulty; a feat, it is added, which could not be performed with an ordinary sword, nor by the (Damascus) sabre itself, in an ordinary hand, though the swordsman who tried it could, it appears, do nearly the same thing with a good European blade.

About the year 1689 an attempt was made to improve and extend the sword manufacture of England by the incorporation of a company of sword-cutlers for making hollow sword-blades in Cumberland and the adjacent counties. The company was empowered to purchase lands, to erect mills, and to employ a great number of German artificers; yet the project failed. Anderson (*Hist. of Commerce*, vol. ii., p. 587) states that the first patentees assigned their rights to a company of merchants in London, who, apparently to the neglect of the original objects of the association, purchased forfeited estates in Ireland to the value of 20,000*l.* per annum. These were subsequently sold off, and the corporation was broken up.

Owing, apparently, to the parsimony of the manufacturers, which led them to use inferior materials, and to employ unskilful workmen, English sword-blades fell into very ill repute during the eighteenth century; so much so, indeed, that an English officer would not trust his life to the hazard of the probable failure of a sword of native manufacture. In 1783 the sword-sellers of London, in consequence of the very bad quality of English blades, petitioned the lords of the treasury for permission to import German swords free of duty; and this circumstance, by attracting public attention forcibly to the low state of this branch of British cutlery, led to very important improvements. A full account of the proceeding is given in Gill's 'Technological Repository,' in a paper entitled 'Recollections of the late Thomas Gill,' by his son, the editor of that work. From this we find that Lord Surrey (afterwards the fourteenth duke of Norfolk) wrote to Mr. Eyre of Sheffield, on the 1st of October, 1783, informing him of the petition alluded to, and requesting such information from any Sheffield manufacturer as would enable him to remove the disgraceful imputation thrown by it upon English ingenuity. Mr. Eyre communicated an extract of the letter to the late Mr. Gill, of Birmingham, and he, in the month of December following, memorialized the lords of the treasury, stating that he could make sword-blades equal to those of Germany, and requesting a fair comparison. Circumstances delayed the public trial which he desired; but in 1786, the East India Company requiring 10,000 horsemen's swords, divided their orders indiscriminately among English and German manufacturers. Owing to the exertions of Mr. Gill, by whom some of these swords were made, a comparative trial was appointed, and every sword sent in was submitted to a machine recommended by Matthew Boulton of Soho, in which the temper was tried by forcing it into a curve, so as to reduce its length from thirty-six inches to twenty-nine inches and a half. The result was that 2650 of Mr. Gill's swords bore the test, and only 4 were rejected, while of the German swords 1400 were received and 28 rejected; the proportionate number of defective blades sent by the German manufacturers being 13 to 1, as compared with those of Mr. Gill. The extremely low state of the British sword-manufacture at that time is sufficiently testified by the fact that of the blades sent by other English cutlers, 2700 were received and 1084 rejected, the proportion being rather more than two bad to five good blades. In addition to the above-mentioned test, Mr. Gill tried his swords by striking them flatways upon a slab of cast-iron, and edgeways upon a cylinder of wrought-iron, sometimes a piece of a gun-barrel, which they often cut through. They were so tough, although formed of cast-steel, that, after cutting a gun-barrel asunder, Gill would frequently wind the blade round it like a riband, after which it would recover its original straightness, excepting at the point. So completely did he establish the fame of his swords, that even German officers applied to him for them; nor was his attention devoted solely to the excellence of their temper, for he also made many improvements in the ornamenting of swords by blueing, gilding, and embossing.

The process of manufacturing swords at Birmingham has been described by Holland, from whose work the following particulars are derived. The material of which the blade is wrought should be cast steel of the very best quality, and wrought with the greatest care. Of this material, besides the quantity prepared at Birmingham, much is obtained from Sheffield in the form of bars, called sword-moulds. These bars are heated in the fire, and drawn out upon an anvil by two workmen with hammers, giving alternate strokes. When the blade is required to be concave upon the sides, or to have a reeded back, or some similar ornament, it is hammered between steel bosses or *swages*. The blade is then hardened by heating it in the fire until it becomes worm-red, and dipping it, point downwards, in a tub of cold water. It is tempered by drawing it through the fire several times until the surface exhibits a bluish oxidation, which takes place at a temperature of about 550° Fahr. The sword is then *set* to the required shape by placing it on a sort of fork upon the anvil, and wrenching it by means of tongs in the direction required to correct any degree of warping which it may have contracted during the hardening. The grinding is performed upon a stone with either a flat or fluted surface, according to the kind of blade; and as the uniformity of the temper is impaired by this process, it is subsequently restored by a slight heating, after which the blade is glazed with emery, and, if the instrument be a fine one, with *crocus martis*, after the manner of a razor-blade. The sword is then ready for the hilt or handle, the various kinds of which it is needless to enumerate.

Among the tests to which sword-blades are subjected in order to prove their flexibility and elasticity, is that of bending them into a curve by pressing the side of the blade against six or eight pegs or stout nails driven into a board, in such a manner that, when in contact with all the pegs, the middle of the blade may be bent six or seven inches from a straight line drawn between the point and the hilt. A further test is applied by an apparatus consisting of a vertical pillar rising from a board. The point of the sabre is placed upon the board at the foot of the upright pillar, and the hilt is then pressed down until the middle of the blade bends away from the upright piece to the required degree; the amount of curvature being shown by a peg which projects horizontally from the pillar, about midway between the top and the bottom. The temper is also proved by striking the blade smartly upon a table on both sides, and by severe strokes with the back and edge upon a block. Mr. Inglis, in his 'Spain in 1830,' vol. i., p. 396, describes the trials to which sword-blades are subjected at the celebrated manufactory of Toledo. Each sword is there thrust against a plate in the wall, and so bent into an arc forming at least three parts of a circle, and then struck edgeways upon a leaden table with all the force which can be given by a powerful man holding it with both hands. The polishing, according to the same authority, is performed upon a wheel of walnut-wood.

Many plans have been tried for imitating the peculiar waved appearance of Damascus blades, which is commonly called *damasking*. Dr. Ure has noticed some of these in his 'Dictionary of Arts,' art. 'Damascus Blades.' He observes that the Oriental processes have never been satisfactorily described, although several methods have been devised in Europe for imitating the Eastern fabrics. Of these he states, without referring to the original authority, that MM. Clouet and Hachette have pointed out three methods of attaining the desired object. The first, which is stated to be still pursued by some French cutlers, consists in scoop-

ing out with a graving-tool the faces of a piece of stuff composed of thin plates of steel of different kinds; and by a subsequent operation filling up the hollows, and bringing them to a level with the external faces, upon which they form a figured appearance. The second is called the method of *torsion*, and is, according to the same authority, more generally employed at present. It consists in forming a bundle of rods or strips of steel, which are welded together into a well-wrought bar, which is twisted several times about its axis. It is repeatedly forged, and twisted alternately; after which it is slit longitudinally, and the two halves are welded with their outer sides together. The surfaces of such a bar have a curious waved or watered appearance, owing to the inter-twisting of the several rods of which it is composed. The third, or *mosaic* method, consists in preparing a bar in the way last described, then cutting it into short pieces, and forming them into a faggot; taking care in welding them together to preserve the sections of each piece at the surface of the blade. 'The blades of Clouet,' observes Dr. Ure, 'independently of their excellent quality, their flexibility, and extreme elasticity, have this advantage over the Oriental blades, that they exhibit in the very substance of the metal designs, letters, inscriptions, and, generally speaking, all kinds of figures which had been delineated beforehand.'

An opinion which has been very often repeated is that Damascus blades are formed by some peculiar union of iron and steel; and, be this as it may, the experiments published some years since at Milan, by Professor Crivelli, show that sword-blades of excellent quality may be produced by such a combination. A notice of his work on the manufacture of Damascus blades was published in the 'Allgemeine Militär-Zeitung,' and thence transferred to the English 'United Service Journal,' for June, 1830, p. 749. According to his method, a bar of malleable steel, of about an inch and a half in breadth and one-eighth of an inch in thickness, is to be bound round with iron-wire, at intervals of one-third of an inch. The iron and steel are then to be incorporated by welding, and repeated additions of iron-wire are to be applied and incorporated in the same way. The compound bar thus formed is then stretched and divided into shorter lengths, which are subsequently wrought into the required form, ground, and tempered. By filing semicircular grooves into both sides of the blade, and again subjecting it to the hammer, a beautiful damasked appearance is produced; and the figures or waterings are rendered visible by washing the blades with a menstruum of aquafortis and vinegar, so as to corrode the surface slightly. According to the account referred to, the swords made in this way are of extraordinary tenacity, and are not very much more expensive than those in common use. The process is said to have been practised successfully in Austria and Prussia.

Another way of explaining the variegated appearance of Damascus blades is that of M. Bréant, examiner-general of the assays at the royal mint in Paris, whose experiments are noticed more fully by Holland and Dr. Ure than they can be in this place. He supposes that the oriental damask is not a mixture of steel and iron, but simply cast-steel charged with a superabundance of carbon; so that, by slow cooling, two distinct combinations are formed, the first being simply steel, and the second a mixture of steel with the excess of carbon, forming a carburetted steel or cast-iron. These two compounds form a kind of crystallized surface, which, by washing with acidulated water, assumes a damasked appearance; the parts consisting of pure steel becoming black, while the carburetted steel remains white.

Besides the numerous contrivances for producing the variegated appearance of Damascus blades, ingenious processes are resorted to for ornamenting sword-blades by etching and embossing, and by inlaying them with gold and silver wire, an art to which the name of *damaskeening* is sometimes applied. In the most perfect way of executing this kind of ornament, the design is deeply engraved upon the steel, the lines or notches being cut of a slightly dove-tailed form, or wider at the bottom than at the top, and a thick wire of gold or silver is forced into the incisions, the form of which enables them to hold it firmly.

(Holland's 'Treatise on Manufactures in Metal,' in Lardner's *Cabinet Cyclopædia*, vol. i., chap. 14, and vol. ii., chap. 4: Dr. Ure's *Dictionary of Arts*, &c.; Gill's *Technological Repository*, vol. vi., p. 12, &c.)

SY'BARIS (Σύβαρις), a Greek city in Lucania, in southern Italy. It was situated between two rivers, the Crathis, now called Crati, and the Sybaris, which at present is called Coscile, Coscilello, or Siburi. It was a colony founded about the year B.C. 720, by Achaians and Troezenians. (Aristotle, *Polit.*, v. ii., p. 156, ed. Göttling.; Strabo, vi., p. 244.) Strabo, without mentioning the Troezenians, calls it an Achaian colony founded by Isoliceus. In consequence of the fertility of the district, this colony soon increased in wealth and power; for at the time of its greatest prosperity, that is, about two hundred years after its foundation, it had, according to Strabo, acquired the dominion over four neighbouring tribes, had twenty-five subject towns, the city itself occupied a space of fifty stadia in circumference, and the Sybarites were enabled to send an army of 300,000 men into the field, a number which does not by any means appear so unreasonable as some modern writers have thought. (Strabo; Diodorus Sic., xii. 9.) Sybaris itself also became the mother of other colonies, such as Posidonia, and carried on a considerable commerce, especially with Miletus in Asia Minor. But the prosperity of Sybaris had a pernicious influence on the people, and within the short period of two hundred and ten years that Sybaris existed, the effeminacy and the luxury of the inhabitants were carried to such a pitch, that the name Sybarite became proverbial and synonymous with a voluptuous person. Many curious particulars in illustration of their effeminate character are mentioned in Athenaeus, which it would be difficult to believe if they were not reported on the authority of Aristotle, Timaeus, and Phylarchus. Thus it is stated, among other things, that it was forbidden by law to carry on within the city any trade or craft which made a noise, or might possibly disturb the citizens in their sleep; and for the same reason no person was allowed to keep cocks. (Athenaeus, xii., p. 518, &c.) The arts which contributed to the enjoyment of life were prized most highly; and those who distinguished themselves as inventors in this line were considered benefactors to the nation. A Sybarite of the name of Smindyrides is called by Herodotus the most luxurious man that ever lived; and it is said that when he went to Sicyon to sue for the daughter of Cleisthenes, he was accompanied by one thousand cooks and fowlers. (Herodotus, vi. 27; Athenaeus, xii., pp. 511 and 541; compare Perizonius on Aelian, *Var. Hist.*, ix. 24.)

It is probable that all we read about the effeminacy of the Sybarites applies only to the ruling aristocracy. The government appears to have always been in the hands of the aristocracy, which, as the words of Aristotle seem to suggest, consisted of the Troezenians, while the Achaians, who in numbers far exceeded the Troezenians, formed the commonalty. These two parties were engaged in a continual struggle, which at last, when it broke out into a civil war, led to the total destruction of Sybaris. About the year B.C. 510, Telys, who himself belonged to the nobles, and who is called by some writers king, by others tyrant, and by others again a demagogue of Sybaris, placed himself at the head of the popular party. (Herodotus, v. 44; Athenaeus, xii., p. 521; Diodorus, as above.) He wished to gratify some personal animosity against the nobles, and excited the people against them so much, that an insurrection broke out, in which the people drove the aristocrats, to the number of five hundred, out of the city, and divided their property among themselves. The exiles fled to Croton, and implored the protection of the Crotoniatae. Telys sent a haughty message to Croton, requiring the citizens either to surrender the fugitives or to prepare for war. The Crotoniatae, it is said, on the advice of Pythagoras, resisted the demand of the Sybarites, and accepted the challenge. Sybaris sent out an army of 300,000 men, while Croton could muster no more than 100,000, under the command of Milo, the celebrated athlete, to whose prowess alone Diodorus absurdly ascribes the victory of the Crotoniatae. The Crotoniatae are said to have been supported by Dorieus of Sparta; and according to another tradition, by Callias of Sybaris, a seer who had forsaken his own countrymen because several omens had happened which were unfavourable to the Sybarites. (Herodotus, v. 44; Phylarchus ap. Athen., xii., p 521.) The victory of the Crotoniatae was complete, and the reaction at Sybaris, described by Heraclides Ponticus (Athen., xii., p. 512), in which Telys and his principal partisans were murdered at the altars of the gods, probably took place after the battle with the Crotoniatae, as it would otherwise have rendered the war altogether unnecessary. The conquerors advanced towards Sybaris: the city was taken, sacked, and razed to the ground, and most of the inhabitants put to the sword. The river Crathis was turned

through the ruins to obliterate every trace of its former greatness (510 B.C.) Within seventy days Sybaris, from one of the most flourishing cities in Italy, became a heap of ruins. The whole population of Miletus mourned over the fate of the Sybarites. A few of the former inhabitants of Sybaris, who survived the fate of their native city, still clung to the spot; and fifty-eight years later, some Thessalian adventurers having arrived there, the town was rebuilt; but after it had existed for five years it was again destroyed by the Crotoniatae. Its inhabitants now solicited the aid of Athens and Sparta; but the former alone sent them ten ships under Lampon and Xenocrates, and on the advice of an oracle these Athenians, with whom was Herodotus the historian, and Lysias the orator, together with many other Greeks and the remnant of the Sybarites, founded, in B.C. 444, the colony of Thurii, a little to the south of the site of Sybaris. In this new colony the Sybarites wished to form a kind of aristocracy, and claimed privileges which their fellow-settlers were unwilling to allow them. The consequence was that in the ensuing struggle all the remaining Sybarites were destroyed.

The site of the antient Sybaris is at present unknown, but it is generally supposed to have been situated near the modern Torre Brodognato or Terra Nuova.

SYCAMORE. [ACER.]

SYDENHAM, THOMAS, one of the most distinguished of English physicians, was the son of a country gentleman at Winford Eagle in Dorsetshire. He was born there in 1624, and was admitted a commoner of Magdalen Hall, Oxford, in 1642. The occupation of that city as a garrison by Charles I. interrupted his studies for a time; but he returned to Magdalen Hall when Oxford was given up to the parliamentary forces, and in 1648 he took the degree of bachelor of physic.

It has been stated that Sydenham served for some time in the royal army during the commotions of the civil war; but this assertion rests on no good authority, and all Sydenham's connections belonged to the republican party. His elder brother William was a colonel in the parliamentary army, and rose during the commonwealth to the highest posts. It was also through the interest of his party that Sydenham obtained, about 1648, a fellowship of All Souls' College, in the place of a person who had been ejected for his royalist opinions. He pursued his studies at Oxford for some years, and is said by the famous French surgeon Desault to have visited Montpellier, where there was a medical school, which then enjoyed a very high reputation. Subsequently he quitted Oxford; and having taken the degree of doctor of medicine at Cambridge, he became a licentiate of the College of Physicians, and settled in London.

He soon rose to the top of his profession, and, between the years 1660 and 1670, had a more extensive practice than any other physician. This success must have been entirely due to himself, for, from some cause of which we are ignorant, the College of Physicians, as a body, were hostile to him; while his known relations to the republican party would cut off court patronage or favour. After suffering for many years from the gout, he died on the 29th December, 1689, at his house in Pall Mall, and was buried in the aisle of St. James's Church, Westminster.

In 1666 Sydenham published his first work, which consisted of observations upon fevers. An enlarged edition of this treatise appeared under a new name in the year 1675. This second edition contained his remarks on the small-pox and on other eruptive fevers, and is remarkable not only for the singularly accurate description of symptoms, but also for the recommendation of a practice directly opposed to the heating and stimulating plan of treatment which then universally prevailed. Remarks on the epidemic diseases of London from 1675 to 1680; a treatise on dropsy and on the gout; and a tract on the rise of a new fever, were his principal other publications.

From the nature of their subjects, we cannot here enter upon an examination of these works; but it is worth while, in the case of a man who acquired such high eminence as Sydenham, to inquire what were the causes to which he owed his great celebrity. He was not a learned man, and his works, written by him originally in English, were translated into Latin before publication by his friends Dr. Mapletoft and Mr. Havers. He constructed no brilliant theory, and indeed was not always consistent in following that which he adopted. Were we to reckon Sydenham among the followers of any particular school, it would be among those of the chemical physicians, who sought for the causes of disease in a supposed fermentation and chemical decomposition of the fluids of the body. Sydenham's method of treating small-pox however, though so great an improvement on the practice which then prevailed, was in opposition to the theory which he had embraced. But his chief merit consists not so much in his method of treatment, which is not unfrequently defective, as in his singular talent for observation. The pictures which he has drawn of diseases are so accurate, that in many instances it would not be possible to improve upon them. He betook himself to carefully noting the symptoms of disease, and the encouragement of his friend Locke assured him that his was the right method of seeking for truth. This it is which constitutes his merit, that, in an age of brilliant theories, he applied himself to questioning Nature herself; justly thinking that though 'the practice of physic may seem to flow from hypotheses, yet, if the hypotheses are solid and true, they in some measure owe their origin to practice.' By treading in this path Sydenham has gained a name which will last: while many, his superiors in learning, perhaps his equals in genius, are forgotten, or remembered only as instances of the misapplication of great gifts to little purpose.

Further particulars concerning Sydenham may be found in Hutchinson's 'Biographia Medica,' vol. ii., p. 430; in the Life prefixed to the English translation of his works by Dr. Swan; and in a volume of the 'Family Library,' entitled 'Lives of British Physicians;' but a good biography of him is still a desideratum. His works have passed through various editions, both in this country and on the Continent. The edition entitled 'Opera Medica,' published at Geneva, in two volumes, 4to., in 1716, is preferable to the English editions. The translation of his works by Dr. Swan is well executed; the best edition of it is that of Dr. Wallis, in 2 vols. 8vo., published in 1789.

SYDENHAM, FLOYER, born in 1710, was educated at Wadham College, Oxford, and took the degree of M.A. in 1734. Having undertaken the laborious and unproductive task of translating Plato into English, he issued proposals for publishing his work by subscription in 1759, accompanied by a 'Synopsis, or General View of the Works of Plato.' The subscribers were few; and some, it is said, failed in their engagements; and after a life of labour and want, he died in old age (April 1, 1787), imprisoned for a debt contracted at the eating-house which he frequented. Melancholy as was his end, it was honoured in its results; for in consequence, 'one of the members of a club at the Prince of Wales Coffee-house proposed that it should adopt as its object some means to prevent similar afflictions, and to assist deserving authors and their families in distress;' and this was the origin of that valuable charitable institution, the Literary Fund, from an account published by which the above quotation is taken. Sydenham is therein characterised as 'a man revered for his knowledge, and beloved for the candour of his temper and gentleness of his manners.'

Between 1759 and 1780 Sydenham published translations of the Io, Greater and Lesser Hippias, Banquet, Rivals, Meno, First and Second Alcibiades, and Philebus, with notes: these are collected in three quarto volumes. These versions were afterwards included by Thomas Taylor in his complete translation of Plato, 1804, revised, and with a selection of the notes. Taylor complains, while paying tribute to Sydenham's natural powers, that from early prejudices, and the pressure of distress, he was unequal to the reception and explanation of 'Plato's more sublime tenets. His translation however of other parts, which are not so abstruse, is excellent. In these he not only presents his reader faithfully with the matter, but likewise with the genuine manner of Plato.' (*Introduction.*)

Sydenham's other works are, 'A Dissertation on the Doctrine of Heraclitus, so far as it is mentioned or alluded to by Plato,' 1775; 'Onomasticon Theologicum, or an Essay on the Divine Names, according to the Platonic Philosophy.

SYDNEY, the capital of New South Wales, in the east coast of Australia, in the county of Cumberland: the town is situated on the south side of the beautiful bay called Port Jackson, in 33° 55′ S. lat. and 151° 25′ E. long.

The east coast of Australia, north and south of the entrance to Port Jackson, consists of sandstone cliffs rising precipitously from the water's edge to the height of 200 or 300 feet. On approaching the coast from the east, the

line of perpendicular cliffs appears to be continuous; but, on coming nearer, an opening is perceived between two lofty headlands, which are called the North Head and the South Head. Within these headlands, a point of land called Middle Head stretches out from the south side of the bay in such a manner as to protect it completely from the easterly winds and the swell of the Pacific. After passing round Middle Head a capacious bay is seen, which extends in a westerly direction about fifteen miles from the coast, the width varying from about a mile to three miles, with excellent anchorage for the largest vessels. This is Port Jackson, a natural harbour, the finest perhaps in the world. Along the north and south shores of Port Jackson there are numerous coves, or inlets, and there are several islands in it. The north shore is rather high, very rocky, and thickly covered with a dark and stunted vegetation; houses are seen here and there on the margin, each with its small verdant inclosure. The south shore offers more pleasing scenes, cottages on the sandy beach behind South Head, promontories crowned with handsome mansions, surrounded by groves and lawns: on approaching Sydney numerous buildings are seen, inhabited by the civil officers of the colony; the government-house, several windmills on the high ridges near the town, and forts and batteries, completed or in progress, are conspicuous objects. Port Jackson at the entrance is about three-quarters of a mile wide, but it soon spreads out to about three miles. At Sydney the width is a mile and a half. There is a lighthouse on South Head, called Macquarrie Tower, which is visible thirty miles at sea; and not far from it is a signal-station, whence telegraphic communications are made to Sydney of the approach of vessels towards the coast. Fifteen miles inland, at the head of the bay there is a creek, seven or eight miles long, and navigable for boats of 12 or 15 tons burthen. At the head of this creek is the town of Parramatta, and the creek itself is called Parramatta River, from a small but constant stream which flows into it.

Sydney is about seven miles from South Head, on the south shore, and is built partly on the west side of Sydney Cove, but chiefly on the low ground behind two rocky promontories, which are separated by three inlets, Farm Cove, Sydney Cove, and Darling Harbour, or Cockle Bay. Previous to the arrival of Governor Macquarrie in 1810, Sydney was little better than an irregular village of houses, cottages, and bark-covered huts, built by each proprietor in such a situation and in such a manner as suited his convenience. Macquarrie however laid down a plan for the construction of the town, according to which the greater part of it is now built; the principal streets run inland to the south, and are crossed at right angles by others which terminate on the west at the shore of Darling Harbour. The Government House and Government Domain limit the extension of the town to the east and north-east: it extends to the south, from Dawes's Battery to the burial-grounds, nearly three miles. Sydney Cove reaches only a short distance inland: there are two forts at the entrance, Macquarrie Fort at the point of the east promontory, and Dawes's Battery on the ridge of the west promontory. Darling Harbour is much more extensive than Sydney Cove, running inland to the south some distance beyond the town. A finer situation for a large mercantile city can hardly be imagined. The water is deep, the shores are precipitous, and the wharfs so situated that cargoes can be hoisted from the holds of the largest ships up to the floors of the warehouses.

The houses in the principal streets are generally two stories high, but many are three; some are built of brick, some of sandstone, and some are of wood. Many of the shops are fitted up with plate-glass windows, chandeliers, and other decorations, in the most costly style of London or Paris. The side-pavements for foot-passengers are made with small stones, not with flags, but asphalte has been introduced, and is extending.

There are no public buildings in Sydney which particularly merit notice for their architecture. The Government House is beautifully situated on the east side of Sydney Cove: the building has become large by additions, but is of the plainest and simplest kind. The Commissariat Store is an extensive stone building, into which the largest ships may discharge their cargoes. The Military Hospital stands conspicuously on the summit of the high ground between Sydney Cove and Darling Harbour. St. Philip's church, built in 1798, is the oldest in the town. St. James's church is a large but plain brick building, with a lofty and rather handsome spire. St. Andrew's church was building at the latter end of 1841, and is probably now completed. The Roman Catholic chapel, in Hyde Park, is a Gothic edifice of hewn stone, and the most handsome structure in Sydney. The Scotch church is a plain building of freestone, with a square belfry tower. The Independent chapel is also plain, but commodious. The Court House is a large brick building. The Council Chambers, and the Colonial Hospital, near them, occupy a conspicuous situation. The Convict Barracks is a large and commodious structure. A new barracks is building, the cost of which is estimated at 200,000*l.* Sydney College is in Hyde Park. The buildings of the Australian College, which were constructed by the mechanics who accompanied the Rev. Dr. Lang from Scotland, form a splendid row of houses, on the plan of the New Town of Edinburgh. The Asylum for the Aged and Infirm is an extensive building, and there is also a Lunatic Asylum. The market-place consists of four oblong buildings, and is a very convenient structure. Besides this market, which is towards the centre of the town, there is a corn-market and a cattle-market at the south end of the town. All the markets are abundantly supplied. The Royal Victoria Theatre, built in 1840-41, is about the size of the English Opera-house in London.

The population of Sydney, according to the census of June, 1833, was 16,232; consisting of 9813 males, of whom 1855 were convicts, and 6419 females, of whom 885 were convicts. At the beginning of January, 1838, the population had risen to 20,000. The latest census, which we extract from the New Zealand Journal of November 13, 1841, is as follows:—

Born in the colony	7,000
Arrived free	17,332
Others free	3,356
Ticket-of-leave holders	207
Convicts in government employ	1,018
Convicts in private service	1,060
	29,973

From January 1, 1841, to November 30, 1841, there were introduced into New South Wales 16,612 emigrants by government aid. They were taken out in 89 ships of the largest class, from 450 to 1000 tons burthen; of these, 55 landed their passengers at Sydney, and 34 at Port Phillip. In addition to these bounty-emigrants, there were about 2000 others who had no aid, making an addition to the population of New South Wales in eleven months of 19,000. The sum expended by the colonial government in the introduction of these emigrants into the colony was 276,682*l.* In 1833 the number of houses in Sydney was 1800; in October, 1841, the number was 4593, of which 3457 were of stone or brick, and 1136 of wood. Of these houses 102 were uninhabited, and 77 unfinished. The average number of inhabitants to a house was rather more than 6½. Thus in the eight years from 1833 to 1841 the increase of the population of Sydney was 13,741, and the increase in the number of houses in the same period was 2793.

Building-ground in the principal streets of Sydney is enormously dear. House-rent also is exceedingly high.

In 1839 the commerce of Sydney employed 50,000 tons of British shipping, navigated by 3000 seamen; and there were 150 vessels belonging to Sydney, worth 300,000*l.*

In 1833 the mills at Sydney for grinding and dressing grain amounted to 17, namely, 4 worked by steam, 3 by water, 1 by horse-power, and 9 windmills. There were 2 distilleries and 8 breweries. Of manufactories there were 4 soap and candles, 1 hats, 7 coarse woollens, 2 tobacco and snuff, 1 rope, 4 coach, 2 starch, 5 tanneries, and 2 sawing-mills. At Canterbury, 4½ miles from Sydney, a large manufactory for the refining of sugar was erecting in 1841, and is probably now finished. It is calculated to refine ten tons of sugar per day. The reservoir for the supply of the two large steam-boilers holds 9000 gallons of water.

The wages of mechanics average from 5*s.* to 8*s.* a day; and all trades required in house building and furnishing are in great and constant demand. Provisions and fruit are abundant, and at reasonable prices: beef and mutton, according to the season, from 4*d.* to 6*d.* per lb.; pork, 9*d.*; veal, 10*d.*; 2-lb. wheaten loaf, 4*d.*; butter, 2*s.* 3*d.* per lb.; potatoes, 2*d.* per lb., or 14*s.* per cwt.; maize, 5*s.* 6*d.* per bushel; wheat, 9*s.*; English barley, 7*s.* 6*d.*; flour, 22*s.* per cwt.; eggs, 1*s.* 6*d.* per dozen; fowls, 5*s.* a couple; Port

Arthur coals, 16s. a ton. Fish is chiefly brought from Botany Bay overland in carts, a distance of seven miles.

In September, 1841, the assets of the Bank of Australasia were 763,673*l.*, the liabilities 342,444*l.*; Commercial Bank, assets 536,599*l.*, liabilities 271,804*l.*; Union Bank, assets 574,915*l.*, liabilities 216,779*l.*; Sydney Banking Company, assets 197,075*l.*, liabilities 42,109*l.*; New South Wales Bank, assets 462,530*l.*, liabilities 255,903*l.*; Bank of Australia, assets 415,047*l.*, liabilities 180,345*l.* The liabilities of these banks consist of notes in circulation, bills, and cash deposited; the assets, of bullion, coin, &c. There is also a savings-bank at Sydney. A mutual insurance company was established in 1840, which, in the year ending August, 1841, had insured property to the amount of 750,725*l.*, the premium received having been 5244*l.*

Sydney is the great emporium of literature for Australia and the neighbouring islands. There are eight newspapers published in the town: one, the Sydney Herald, daily; the rest are mostly thrice and twice a week. The Colonial Society, for concentrating information on colonial subjects, had, in December, 1841, 807 members; the receipts for 1840 were 2361*l.*, the expenditure 1909*l.* There is a flourishing Mechanics' Institute called the School of Arts.

Of scholastic institutions there are the Sydney College, with about 120 scholars, and the Australian College, with about 70. The latter was founded by the Rev. Dr. Lang, in 1833, by means of a loan of 3500*l.* from the colonial government, but only 1800*l.* of the subscription money had been paid up in October, 1841. In 1833 there were in Sydney six free-schools supported by the government, with 450 scholars educated on the Madras system, and there was a female school of industry supported by voluntary contributions, with 22 scholars.

Steam-boats ply daily between Sydney and Hunter's River, and two steam-boats leave Sydney every Sunday morning for Parramatta.

Sydney, being the seat of the colonial government of Eastern Australia, is the residence of the governor, and here the legislative council holds its sittings. It is also the seat of the supreme court of justice and of the police court.

The distance of Sydney from Plymouth by the Cape of Good Hope is about 13,000 miles.

In 1787 the British government had determined to form an establishment in Australia, in order 'to empty the gaols and houses of correction; to transplant the criminals to a place where, by labour, with moral and religious instruction, their conduct may be reformed; to afford at the same time an asylum for free emigrants; and to provide a present relief and future benefit to the mother-country.' With these objects in view Captain Arthur Phillip, of the royal navy, sailed from Portsmouth, May 13, 1787, with 11 ships, intending to settle the colony at Botany Bay, where he arrived January 20, 1788. Botany Bay however was found to be by no means an eligible harbour, being open to the easterly winds, which whenever they blow violently roll in a heavy sea from the Pacific; besides that the land which Sir Joseph Banks had represented as a series of beautiful meadows was found to be nothing but swamps and sand. Captain Phillip sailed immediately in search of a more suitable place of settlement, and fixed in a few days on the locality of the shores of Sydney Cove in the bay of Port Jackson. Port Jackson is said to have derived its name from a sailor of the name of Jackson who first discovered the entrance between the two headlands, and the name of Sydney is stated to have been given to the new town in honour of Lord Sydney, who was a lord of the admiralty (some say, a secretary of state) at the time when Captain Phillip settled the colony on its present site.

(Lang's *History of New South Wales;* Jameson's *New Zealand, South Australia, and New South Wales*, 1842; Wentworth's *Description of New South Wales;* Breton's *Excursions in New South Wales; Sydney Herald*, up to December 23, 1841, &c.)

SYE'NE. [EGYPT.]

SYLBURG (Latinized SYLBURGIUS), FREDERIC, was born in 1536, in the village of Wetter, near Marburg, whence he generally calls himself Fredericus Sylburgius Vetereusis. His father was a farmer in middling circumstances; but the son received a good education, and during the time he spent at the university of Jena, he chiefly devoted himself to the study of Greek under Rhodomannus. After the completion of his academical course, he had the management of several public schools, first that of Lich, in the county of Solms, and then that of Neuhaus, near Worms. But he had no particular liking for the business of teaching, and his occupation took up all the time which he wished to devote to literary labours. Accordingly he gave up his post, and entered into a connection with the printer Andrew Wechel, of Frankfurt on the Main, for whose establishment Sylburg undertook to edit Greek works. He continued at Frankfurt until 1591, when he went to Heidelberg, and formed a similar connection with the printer Hieronymus Commelin. In both places Sylburg, who had the superintendence of the printing of all Greek works, as well as the preparation of them, performed these duties with the utmost accuracy, and showed an extraordinary critical talent in the notes which accompanied almost all his editions. He thus gained great celebrity, and the landgrave of Hessen munificently rewarded him with an annual pension from the funds of the university of Marburg. Further particulars of his life are not known. He died at Heidelberg, on the 16th of February, 1596, as is stated on his tomb-stone, which still exists at Heidelberg.

Sylburg was one of the most eminent and most industrious Greek scholars of the sixteenth century, and the greatest men of the age, such as Casaubon and De Thou, entertained a profound admiration for him. He was a worthy contemporary of Henry Stephens, whose Thesaurus of the Greek language contains many articles by Sylburg. The editions of Greek writers by Sylburg are still very valuable, and in critical accuracy they are not inferior to those of Stephens, although they are not so beautifully printed. Some of his editions have never yet been excelled. His first publications were new editions of some elementary Greek grammars which were then generally used. In 1583 he published, at Frankfurt, in one volume, folio, his edition of Pausanias, with notes by himself and Xylander, and an improved reprint of the Latin translation by Romulus Amaseus. It also contains a dissertation by Sylburg, 'De Grammaticis Pausaniae Anomalis.' The whole was reprinted in 1613. Between 1584 and 1587 he published at Frankfurt a complete edition of Aristotle, in 11 parts, or 5 vols. 4to. This edition only contains the Greek text with the various readings, and is still the best and most correct edition of all Aristotle's works. In 1585 he edited four discourses of Isocrates (ad Demonicum, ad Nicoclem, Nicocles, contra Sophistas), Frankfurt, in 8vo. The year following there appeared by him the first complete edition of the works of Dionysius of Halicarnassus, Frankf., 2 vols. folio. It contains the improved Latin translation of the Roman Antiquities by Gelenius, with very useful notes and indices. This edition has never yet been surpassed: it was reprinted, but very incorrectly, at Leipzig, 1691, 2 vols. folio. From 1588 to 1590, he published, at Frankfort, in 3 vols. folio, the valuable collection of antient writers on the history of Rome, under the title 'Romanae Historiae Scriptores, Latini et Graeci, addita variantis scripturae notatione et notis.' Vol. i. contains the Fasti Capitolini, Messala Corvinus, L. Florus, Velleius Paterculus, S. Aurelius Victor, S. Rufus, Eutropius, Cassiodorus, Jornandes, and Julius Exsuperantius. Vol. ii. contains Suetonius, the Scriptores Historiae Augustae, Ammianus Marcellinus, Pomponius Laetus, J. Bapt. Egnatius, Ausonii Epigrammata in Caesares, Romanorum Imperatorum Catalogus, and Romanae Urbis Descriptio. Vol. iii. contains the Scriptores Graeci Minores Historiae Romanae, that is, the Fasti Consulares (Greek and Latin), Paeanius, Xiphilinus, Herodian, Zosimus, Julian's Caesars, Olympiodorus, and extracts from Suidas. In 1590 he published, at Frankfurt, in 4to., the work of the grammarian Apollonius 'De Syntaxi, seu Constructione Orationis.' The last work that he published in the establishment of Wechel was a collection of some Greek gnomic poets, 'Epicae Elegiacaeque Minorum Poetarum Gnomae, Graece et Latine,' Frankf., 1591, 8vo. A second and much improved collection appeared at Heidelberg in the year of Sylburg's death. All the subsequent editions of Sylburg were published in the printing establishment of Commelin at Heidelberg. In 1592 he edited, in 1 vol. folio, the commentary on the Apocalypse, by Andreas Cretensis, in Latin and Greek; and in the same year he published the editio princeps of the Greek text of the work of Theodoretus, entitled 'Remedia contra Morbos Graecos,' with the Latin translation of Zenobius Acciajuoli, and notes by himself. In 1592 he also edited the complete works of Clemens of Alexandria, with notes, folio; and in 1595, in

folio, all the works of Justin the Martyr. This edition is founded upon that by Robert Stephens in 1551, but Sylburg improved the text, and added very useful notes: it is still the standard edition. In 1594 he edited the 'Etymologicum Magnum,' in folio, with notes and a very useful index. The year after he edited 'Saracenica, sive Collectio Scriptorum de Rebus ac Religione Turcarum, Graece et Latine,' in 8vo. Among other less important writers, it contains a refutation of Mohammedanism by Euthymius Zigabenus, and a Life of Mohammed by an anonymous Greek writer. Sylburg, on his death, left in MS. a considerable number of materials which he had collected for an edition of Herodotus, and which were afterwards made use of by Jungermann in his edition of Herodotus, Frankfurt, 1608, folio.

(J. G. Jung, *Vita Frederici Sylburgii*, Berleburg, 1745, 8vo.)

SYLFIELLEN. [SWEDEN.]

SYLHET. [SILHET.]

SYLLA. [SULLA.]

SYLLABLE (συλλαβή). A syllable consists of one or more elementary sounds of a language uttered in one emission of voice. The pronoun *I* is an example of a syllable consisting of but one elementary sound; and the syllable *strange* is an example consisting of several elementary sounds articulated (joined) together. Words which consist of one syllable are termed monosyllabic; those consisting of two are termed disyllabic; those of three, trisyllabic; and those of more than three are indefinitely termed polysyllabic.

Spoken language is a system of audible signs for the expression of thought, and written language is a system of signs to express spoken language, so that written language is two removes from thought. Syllables, both as words and as parts of words, belong both to spoken and written language.

In a pronounced syllable two distinct things are observable: viz., 1st, its elementary structure; and, 2nd, the musical properties of the voice, consisting of those distinctions of sound which are described under the general terms pitch, loudness, and quality. Thus in the pronoun *I* we observe the elementary structure to be the diphthongal vowel *I*, as heard in the word *i*sle [STAMMER]; and we observe also whether the syllable be said or sung, that is, whether the condition of voice belongs to speech or to song; an accurate observer also perceives the precise degree of pitch and loudness and the character of the quality of voice.

The time which a syllable occupies in pronunciation is termed its quantity. In solemn and stately discourse the quantities of syllables are extended beyond their ordinary length; while in rapid colloquy they are somewhat shortened. The ordinary quantity of a syllable, when neither extended nor protracted, is the sum total of the quantities of its constituent elementary sounds: thus the quantity of the syllable *nine* is the sum total of the quantities of its elementary sounds *n*, *i*, of isle, and *n*.

It would occupy much space to describe the operations of the causes which limit and determine the quantities of syllables. Those causes are, the singleness of the vocal emission, and the elementary structure of the syllable. The elementary sounds and their chief modes of succession in English syllables are described in the article STAMMER.

Syllables are of various lengths, from an extremely short to a very long quantity, as in the examples *it, hot, out, long, length, strength*, which form an increasing series.

In words of more than one syllable, one of them is always made more conspicuous to the ear than the other, by what is termed stress or accent. Stress is produced either by an abrupt percussion of voice, as in the word *pep*per, or by an extended quantity on a swelling loudness of voice, as in the word *amaze*. The stressed syllable of a word is invariably that which receives the modification of voice expressive of sense and feeling, called emphasis.

The metrical arrangement of language depends on the quantity and stress of syllables [PROSODY], both of which are inherent; while the pitch, loudness, and quality of voice in which the syllables are uttered are accidental, and belong to the thought and feeling of the speaker. [ELOCUTION.]

Prosodians commonly classify syllables into long, short, and common. Mr. Herries examines their elemental structure in relation to their capacity for extension, which is an important practical consideration.* His remarks may be generalized by stating that when syllables end with extensible elements, they admit of greater extension throughout, than those syllables which are terminated by inextensible elements.

The late Mr. Thelwall carried this inquiry farther by considering the structure of syllables in relation to the smoothness, harshness, vivacity, &c. of the sound of language, and that not in a vain effort

'To make the sound an echo to the sense,'

but simply to bring them in harmony. His illustrations were taken from Shakspere, Milton, and Dryden. To enter upon this subject would occupy more space than can be allotted to it in a work of this nature.

Dividing words into syllables is a different operation according to the object in view, thus: 1, When a word is pronounced in widely separated syllables, to enable a child to appreciate each, as in uttering the word *provided*, thus, *pro-vi-ded*, by which means a child readily apprehends each successive syllable of the word; 2, When a word is analysed into its component parts, in order to exhibit its etymology, and thus lead to a clear apprehension of its signification, as a whole from knowing that of its parts, as in dividing the word *thermometer*, thus, *thermo-meter*; 3, To divide a word into its syllables, to enable another to write it with correctness, as the word *barometer*, thus, *ba-ro-me-ter*.

The correct use of the alphabet in writing words is termed orthography, and is an important part of grammar. [ORTHOGRAPHY.]

The division of written words into syllables is an attempt to exhibit the audible syllables to the eye, and is attended with many difficulties, as the varied divisions in the several dictionaries manifest. Those who seek further information may consult with advantage the principles of pronunciation prefixed to Walker's 'Pronouncing Dictionary;' Herries's 'Elements of Speech;' Thelwall's 'Essay introductory to his Illustrations of English Rhythmus;' Roe's 'Elements of Rhythm;' and Chapman's 'Music and Melody of the English language.'

SYLLIS, Savigny's name for a genus of Dorsibranchiate Annelids, which have tentacles unequal in number, and articulated in chaplets, as well as the upper cirrhi of their feet, which are very simple and have only one packet of bristles (soies).

Example, *Syllis monilaris*. [ANNELIDA; DORSIBRANCHIATA.]

SYLLOGISM (συλλογισμός). The object and character of logic are explained under the word ORGANON; the present article is devoted to the formal part of the science, which consists entirely in the treatment of the syllogism, and the reduction of fallacy to rules of detection. Every sentence in which different assertions are combined to produce another and a final assertion, is either a syllogism, a collection of syllogisms, or a mass of words without meaning: and when we separate the constituent assertions, and write the whole under the forms of logic, we are not thereby ceasing to consider the sentence which contains those assertions, or, as many fancy, dealing with a new species of ratiocination. All that is called reasoning, and which cannot be made syllogistic, is not reasoning at all; and all which cannot easily be made syllogistic, is obscure: for the syllogism is the simple form in which the act of reasoning is an act of intuition.

Aristotle defines syllogism thus: 'Syllogism is speech or language in which certain things being assumed, something different from what is assumed results by virtue of the assumption; and, by virtue of the assumption, I mean it results through the assumption; and, by through the assumption, I mean that no external term is required in order to there being a necessary result.' (*Analyt. Prior.*, i. 1.)

So easy indeed is the deduction, when the premises are properly disposed as preparatory to a syllogism, that many persons doubt the utility of the syllogism altogether. With these we are not now arguing: we shall only observe that he must be fortunate in the clearness of his mind, who, knowing the logical mode, is never obliged to have recourse to it to destroy ambiguity or heighten evidence; and particularly so in his opponents, who, in verbal or written controversy, never finds it necessary to employ it in trying their arguments. The syllogism is the instrument of self-examination, and the weapon of last resort in dispute: and a bad syllogism, with one of the premises implied only, and not expressed, is the first resource of fallacy; which last is sometimes even allowed to remain unrefuted, by neglect of

* 'The Elements of Speech,' by John Herries, A.M., London, 1773, 8vo., pp. 259.

placing it in a logical form. To bring forward the suppressed premiss is the visible destruction of every argument which is logically bad. As an instance, take the following in a letter from Cardan to Tartalea: 'Neither am I moved with envy, *for* if you are either equal to, or less than myself, I have no cause for it; and, if you be greater in this art, I ought to endeavour to equal you, and not to speak evil of you.' This is meant for reasoning, and there are two syllogisms with suppressed premises, or rather two sorites (a term presently explained), with a suppressed premiss in each. In one case Cardan assumes that he does not envy Tartalea because he *need* not; in the other, that he does not because he *ought* to do otherwise: if he meant to assume and assert that he never did anything which he had no need to do, and always did everything which he ought to do, his reasoning is logical: but if he would have hesitated to make these assertions, he was then writing fallacy. In justice to Cardan's logic however, it is but fair to say that he was not the man to hesitate at either assertion. [CARDAN.]

Every sentence in which the conclusion is a necessary consequence of previous assertions contained in that same sentence, is a syllogism, provided that the conclusion be obtained from two distinct assertions, and two only. Thus 'Some As are Bs, for every B is A,' is not a syllogism, though logically true [CONVERSE]. Every assertion may be reduced to one of four forms, the universal affirmative, the universal negative, the particular affirmative, and the particular negative. From these, by combination, all syllogisms are derived; and the laws of combination, and the manner of expressing them, constituted that branch of science which is now often turned into ridicule, particularly as to its notation, and the strange and uncouth words by which the species of syllogisms were denoted. The following letters always signify the several species of propositions:—

A, the universal affirmative; every X is Y.
E, the universal negative; no X is Y.
I, the particular affirmative; some Xs are Ys.
O, the particular negative; some Xs are not Ys.

Since every conclusion must be drawn from the comparison of two things with a third, a syllogism consists of two propositions, in each of which the same term occurs compared with another: this term is called the *middle term*. Thus in

Every Y is X,
Every Z is Y,
Therefore Every Z is X,

Y, the subject of the first assertion, and the predicate of the second, is the middle term. The two first assertions are the *premises*, the third is the *conclusion*. The predicate of the conclusion is called the *major term;* the subject of the conclusion, the *minor term:* and the major or minor premiss is that which contains the major or minor term of the conclusion. The major premiss is always written first.

The order of the terms in the premises and conclusion must be either

I.	II.	III.	IV.
YX	XY	YX	XY
ZY	ZY	YZ	YZ
ZX	ZX	ZX	ZX;

and these are called the four *figures*. The three first are in Aristotle, the fourth was by tradition ascribed to Galen, and was called Galenic. In the first figure the middle term is the subject of the major, and the predicate of the minor; in the second, the predicate of both; in the third, the subject of both; in the fourth, the predicate of the minor and the subject of the major. Every particular case of a figure is called a *mood;* and since either of the premises may be either of the four species of propositions, A, E, I, O, it follows that there are sixteen moods in each figure, or sixty-four possible moods in all. But of these, many are inconclusive, and many moods which admit of conclusion in one figure do not in another. Thus the mood in the example above is AA, and if we apply it in the four figures, we have:—

Every Y is X	Every X is Y	Every Y is X	Every X is Y
Every Z is Y	Every Z is Y	Every Y is Z	Every Y is Z.

The first has a conclusion; every Z is X. The second has none; that is, for anything to the contrary contained in the premises, we may either say every Z is X, no Z is X, some Zs are Xs, or some Zs are not Xs. It also admits every X is Z, but here Z is the major term, and not X; and it is of the first figure, with the premises transposed, and not of the fourth. The third admits a conclusion; some Zs are Xs. The fourth also admits a conclusion; some Zs are Xs. Consequently the first figure has a syllogism AAA, the third and fourth have AAI.

If all the sixty-four cases be examined (a most useful exercise) it will be found that the following syllogisms are valid. We arrange them first by figures, then by moods.

First figure; AAA, EAE, AII, EIO.
Second figure; EAE, AEE, EIO, AOO.
Third figure; AAI, IAI, AII, EAO, OAO, EIO.
Fourth figure; AAI, AEE, IAI, EAO, EIO.

The following is the statement by moods:—

$(AA)A_1I_3I_4$, $(AE)E_2E_4$, $(AI)I_1I_3$, $(AO)O_2$
$(EA)E_1E_2O_3O_4$, $(EI)O_1O_2O_3O_4$,
$(IA)I_3I_4$,
$(OA)O_3$

Here, for instance, we express by $(IA)I_3I_4$ that the mood IA never proves anything but I, and that only in the third and fourth figures. From the preceding we may collect that—

As to figures: any proposition may be proved in the first; none but negatives in the second; none but particulars in the third; and everything but the universal affirmative in the fourth.

As to moods: from premises both negative or both particular, no conclusion follows: where one premiss is negative, the conclusion is negative; and where one premiss is particular, the conclusion is particular.

In order to remember the figures certain words have been long used by writers on logic, which make a grotesque appearance; but if the reader will tolerate them till we have gone through an example of each syllogism, he shall see that those who made them were at least as good wits as those who laugh at them. The magic words of the fourth figure are different in different writers; we have taken those used by Dr. Whateley.

First figure; Barbara, Celarent, Darii, Ferio.

Second figure; Cesare, Camestres, Festino, Baroko.

Third figure; Darapti, Disamis, Datisi, Felapton, Bokardo, Feriso.

Fourth figure; Bramantip, Camenes, Dimaris, Fesapo, Fresison.

Thus the vowels AAA are seen in *Barbara*, AII in *Datisi*. The following are instances of each form, with an example which may easily be reduced to the form.

First figure.

Barbara. Every Y is X, every Z is Y, therefore every Z is X. *Example.* They must, as men, have faults: or all men have faults, these persons are men, therefore these persons have faults; strictly, all men *are* persons having faults, &c.

Celarent. No Y is X, every Z is Y, therefore no Z is X. *Ex.* Those who bribe should not, any more than other lawbreakers, be exempt from punishment.

Darii. Every Y is X, some Zs are Ys, therefore some Zs are Xs. *Ex.* Exploded doctrines are sometimes true, because capable of proof.

Ferio. No Y is X, some Zs are Ys, therefore some Zs are not Xs. *Ex.* Some of the earlier principles of science are not well appreciated for want of attention to the usual modes of operation of the mind.

Second Figure.

Cesare. No X is Y, every Z is Y, therefore no Z is X. *Example.* The presence of horns in this species, and their absence in the other, is a complete distinction between the two.

Camestres. Every X is Y, no Z is Y, therefore no Z is X. The last example will do: this mood is only a consequence of the convention by which the major premiss is to be written first, and of the convertibility [CONVERSE] of the universal negative proposition.

Festino. No X is Y, some Zs are Ys, therefore some Zs are not Xs. *Ex.* Persons who pretend to form an opinion on philosophical subjects are oftentimes incapable of doing it properly, from want of acquaintance with the exact sciences. This example is given purposely, as falling more naturally into another figure, though capable of expression in this.

Baroko. Every X is Y, some Zs are not Ys, therefore

some Zs are not Xs. *Ex.* None but the industrious can succeed, so that there must be many failures.

Third figure.

Darapti.—Every Y is X, every Y is Z, therefore some Zs are Xs. *Ex.* Politics and literature are not necessarily incompatible, for many persons can be named who have cultivated both.

Disamis.—Some Ys are Xs, every Y is Z, therefore some Zs are Xs. *Ex.* Many things inexpedient, because wrong, are apparently useful.

Datisi.—Every Y is X, some Ys are Zs, therefore some Zs are Xs. The last example will do for this also.

Felapton.—No Y is X, every Y is Z, therefore some Zs are not Xs. *Ex.* There are organized bodies to whose existence air is necessary, and which have no locomotive power, as plants, for instance.

Bokardo.—Some Ys are not Xs, every Y is Z, therefore some Zs are not Xs. *Ex.* Even industry does not always succeed, for men of great research have been mistaken.

Feriso.—No Y is X, some Ys are Zs, therefore some Zs are not Xs. *Ex.* It is not true that all who gave evidence were present, for A, B, C, &c. were many miles off.

Fourth figure.

Bramantip.—Every X is Y, every Y is Z, therefore some Zs are Xs. *Ex.* Among repulsive things are the sciences themselves, for they are all difficult.

Camenes.—Every X is Y, no Y is Z, therefore no Z is X. *Ex.* No perfect being can be man, for all men are subject to decay, the unfailing mark of imperfection. This example would do very well as one of the most common species of fallacy, that in which the middle term is used in different senses, so that there is in fact no middle (or *common* middle) term. We have seen this argument used somewhere, 'perfect being' meaning '*morally* perfect being,' and 'imperfection' including *physical* as well as *moral* imperfection.

Dimaris.—Some Xs are Ys, every Y is Z, therefore some Zs are Xs. *Ex.* Some writers who repeat themselves are amusing, for every prolix writer does it, and the most attractive books are not always the shortest.

Fesapo.—No X is Y, every Y is Z, therefore some Zs are not Xs. *Ex.* Some things which are not much written about are not worth learning; not that this circumstance is otherwise an index, except in this manner, that all really useful learning has its opponents, and it is only where there is opposition that much discussion ever takes place. Here is a good instance of the case in which the premises both yield the conclusion, and explain the sense in which it is to be taken: the preceding is no syllogism unless the 'writing about' the subject in the conclusion mean writing about not the subject itself, but whether it be useful or not.

Fresison.—No X is Y, some Ys are Zs, therefore some Zs are not Xs. *Ex.* Some things which are cried up can hardly be relics of antiquity, for they are valueless. Here is an instance of an argument which, logically undeniable, may be disputable as to the *matter*. One of the premises is 'no relic of antiquity is valueless,' which many may be found to deny.

Some other forms have been given, but they are only some of the preceding with the premises transposed, and which therefore do not obey the conventional rule relative to the precedence of the major premiss: as, for instance, one named *Baralipton* (AAI, the last syllable being only a termination) which we may mention particularly, inasmuch as this word has been very often quoted as a specimen of logical terms. It runs as follows:—Every Y is X, every Z is Y, therefore some Xs are Zs. Transpose the premises, and we have the first syllogism of the fourth figure.

Of all the four figures the first is the most natural, and every mood of the other three can be reduced to one of the first, in one of the following ways. It will be seen that every name in the last three figures begins with one of the initial letters of the first, and thus it is pointed out to which mood of the first figure each is reducible. Thus Cesare, Camestres, and Camenes are those which are reducible to Celarent of the first figure.

The other significant letters of the descriptive words are *m*, *s*, *p*, *k*, wherever they occur. By *m* it is implied that the premises are to be transposed; by *s* that the premiss marked by its preceding vowel is to be converted, whence *s* follows only E and I [CONVERSE]; by *p* that the conversion is to be made in a limited manner, or *per accidens* [CONVERSE]; and by *k* that the reduction is made by what is called the *reductio ad impossibile*, a term which we now explain. It means that the syllogism can be replaced by one in the first figure, which proves, not the truth of the conclusion, but the falsehood of its contradictory. [CONTRARY AND CONTRADICTORY.] For example, take the syllogism *Baroko*, or

Every X is Y,
Some Zs are not Ys,
Therefore Some Zs are not Xs.

If the conclusion be denied, it must be by affirming that Every Z is X. Let this be so, then we must have the syllogism *Barbara* as follows:—

Every X is Y,
Every Z is X,
Therefore Every Z is Y.

But, by hypothesis, some Zs are not Ys, whence this conclusion contradicts one of the admitted premises, or must be false. One, then, of the premises which gives it must be false; but since Every X is Y is supposed true, it must be Every Z is X, which is false, or Some Zs are not Xs, which is true. This is a specimen of the persevering determination of the older logicians to make everything reducible to the first figure.

It appears then that few words have ever been invented which have really so much meaning as the now despised appellations of syllogisms. Take, for example, *Disamis* every letter is a sentence. D means that the mood of the first figure into which this can be reduced is Darii; I, that the major premiss is a particular affirmative proposition; S, that the reduction requires the major premiss to be simply converted; A, that the minor is a universal affirmative; M, that the reduction requires the transposition of the premises; I, that the conclusion is a particular affirmative; S, that the conclusion must be simply converted. We thus change

DISAMIS.		DARII.
Some Ys are Xs,		Every Y is Z,
Every Y is Z,	into	Some Xs are Ys,
Some Zs are Xs,		Some Xs are Zs.

A *proper* mood was one in which one of the premises spoke of a single subject, as in 'All Frenchmen talk French, Pierre is a Frenchman, therefore Pierre talks French.' There was much discussion as to whether such a proposition as 'Pierre is a Frenchman' was a universal affirmative or not, it being obvious on all sides that, whether or no, it would have in deduction all the properties of a universal affirmative.

An *enthymeme* is a syllogism in which one premiss is obviously implied, and is the form in which argument is commonly given. For example, 'He isn't here; I don't see him,' implies that the speaker would affirm himself certain of seeing him if he were there, and is an enthymeme which, with the suppressed premiss restored, makes the following syllogism:—

Fig. 2.	A	All that is here	is seen by me.
Camestres.	E	He	is not seen by me.
Therefore	E	He	is not here.

The *sorites* is a collection of *Barbara* syllogisms, in which the suppressed conclusion of the first is a premiss of the second, that of the second a premiss of the third, and so on; as in A is B, B is C, C is D, D is E, therefore A is E. Here are three syllogisms, namely,

A is B	A is C	A is D
B is C	C is D	D is E
A is C	A is D	A is E

Various attempts were made to classify the manners in which common argument is to be expressed syllogistically. The only difficulty is to reduce the expressions to the pure form of simple assertion or negation. An oblique syllogism was one in which one of the oblique cases enters the premises in such a manner as to vitiate the purity of the form. For instance,

The thoughts of man govern his actions,
John is a man,
Therefore John's thoughts govern his actions.

As it stands, this is not strictly a syllogism, and some less idiomatic expressions must be adopted before it can be turned into one. As,

(Every man) is { a being whose thoughts govern his actions,
John is a man,
Therefore John is a being, &c.

The same thing occurs in a *modal syllogism*, which is one in which some modifying expression gives more or less of force to one or both premises. As

Probably Every Y is X,
Every Z is Y,
Therefore Probably Every Z is X.

If we consider both matter and form, we have here merely a syllogism in which one premiss is only probable. [PROBABILITY, p. 28.] But, considering form only, the perfect deduction may be made as follows:—

Every Y is { a thing which is more likely than not to be X,
Every Z is Y, therefore every Z is [a thing, &c.]

The *inductive* syllogism is merely one in which one of the premises is proved by induction, or by separate proof of every instance: as when the Ys are known to be A, B, and C, and no more, and Every Y is X is shown by proving separately that A is X, B is X, C is X. There is nothing peculiar to the syllogism here. [INDUCTION.]

The *hypothetical* syllogism (so called) is one in which the truth of one proposition is stated to depend solely on that of another; so that the first can be affirmed as soon as the second is known to be true, or the second can be denied as soon as the first is known to be false. Thus,

If A be B, C is D,
But A is B, therefore C is D.
Or, If A be B, C is D,
But C is not D, therefore A is not B.

Whenever a proof is complete, except in one proposition—when, for example, we have fully made out that C is D, except only in this that the proposition 'A is B' is not yet proved, the first member of the hypothetical syllogism lays down the state of the argument. When all that will prove a proposition is true, the proposition itself is true, whence there is only need to affirm the one doubtful premiss, to make the conclusion a logical consequence. Again, when a proposition is false, some part of any logical proof must be deniable: hence there is only need to deny the conclusion in order to make the one doubtful premiss logically deniable.

The *conditional* syllogism is reducible to an hypothetical one. It is when, under certain circumstances, the first member affirms a proposition, as in Wherever A is B, C is D.

The *dilemma* is a double or other compound syllogism, in which two or more contradictory propositions form each a conclusion with other propositions, so that from those other propositions necessarily follows one or other of the conclusions: because of contradictory propositions one must be true. It is not therefore a syllogism, but a collection of them. For example, 'He must either have been for, against, or neuter: if for, he was unjust; if neuter, he was mean; if against, he was false: therefore he must have been either unjust, mean, or false.' This presumes the existence of a premiss for each conclusion; as for example, that the cause is that of oppression, that he is so circumstanced that nothing but fear or favour could prevent him from taking part with the right, and that he has pledged himself to the wrong.

The rules of syllogism may be briefly condensed as follows:—

1. One at least of the premises must be affirmative, and one at least universal; 2, the middle term must enter universally in one of the premises; and 3, the conclusion must not speak of any term in a wider sense than it was spoken of in the premiss in which it entered. A term universally spoken of is either the subject of a universal affirmative, or the predicate of any negative.

The first rule is derived from observation, but might be demonstrated. The second is seen thus: if the middle term were not universally spoken of in one premiss, there might be in reality no middle term, or nothing with which to compare the major and minor term. Thus if we attempt to infer anything from Every X is Y, some Ys are not Zs, we merely see that all the Xs are so many of the Ys, or make up a part of the Ys. Some of the Ys (another portion, it may be) are not Zs, so that the common term does not exist, or may not exist. The third rule is obvious, for no more can be made of any assertion than it contains, and an argument which asserts something about every X from premises which only mention some Xs, must be illogical.

The various species of fallacies must consist either in the introduction of unproved propositions, or an illogical use of those which are proved. We do not feel it necessary to extend this article by entering into the usual classification of them.

SYLVE'RIUS, son of Bishop Hormisdas, and a native of Campania, succeeded Agapetus as bishop of Rome, A.D. 535. Theodatus, the Gothic king of Italy, is said to have influenced his election. Soon after, Belisarius came with an army sent by the emperor Justinian, defeated the Goths, and took possession of Rome. Vigilius, a deacon of Rome, intrigued with the court of Constantinople to have Sylverius deposed, on the pretence that he favoured the Goths, and Sylverius was accordingly seized by order of Justinian, and sent into exile to Pàtara, A.D. 537, where he soon after died, and Vigilius was put in his place. (Platina and Panvinio, *Le Vite dei Pontefici*.)

SYLVESTER I. succeeded Melchiades as bishop of Rome, A.D. 314. The Christian church was now in the ascendant throughout the Western world, under the protection of the emperor Constantine. By Constantine's orders a council was assembled at Arelatum (Arles), A.D. 314, at which some deputies of the bishop of Rome were present and in which the Donatists were condemned. [DONATISTS.] But the principal event of Sylvester's pontificate was the great council of Nicæa, A.D. 325, which defined the articles of the Christian faith, and also determined the order of the hierarchy in the various provinces of the empire. The bishop of Rome was thereby made primate over the sees of the provinces styled Suburbicariæ, which, under the new distribution of the empire made by Constantine, were placed under the jurisdiction of the Vicarius Urbis, or imperial vicar of Rome. Sylvester did not repair to the council, but sent thither two presbyters as his deputies, Vitus and Vincentius, who do not appear to have had any particular distinction or post of honour in the assembly. [POPE.] The story of the donation made by Constantine to Pope Sylvester of temporal jurisdiction over the suburbicarian provinces is now universally rejected as apocryphal; it may have originated from the church chroniclers confounding the temporal with the spiritual jurisdictions.

Constantine made a short residence at Rome in Sylvester's time, A.D. 326, but soon left it, being, it seems, dissatisfied with his reception by the people. [CONSTANTINUS, FLAVIUS VALERIUS.] The papal historians speak of numerous churches raised and endowed by Constantine at or near Rome. [LATERAN.]

Sylvester died A.D. 335, and was succeeded by Marcus. His supposed epistles and decretals are now considered apocryphal. (Platina and Panvinio, *Vite dei Pontefici*; Walch, *History of the Popes*.)

SYLVESTER II. [GERBERT.]

SYLVESTER, styled III., Antipope, was proclaimed pope by a faction in Rome in opposition to Benedict VIII., A.D. 1013; but after a few weeks a fresh tumult at Rome drove away Sylvester, and reinstated Benedict.

SY'LVIA. [SYLVIADÆ.]

SY'LVIADÆ, Mr. Vigors's name for a family of *Dentirostres*, the second tribe of his order INSESSORES.

Mr. Vigors remarks that the *Sylviadæ*, the *Warblers* of our British ornithologists, assimilated as they are to the MERULIDÆ in the sweetness and compass of their vocal power, are separated from that family chiefly by their more delicate structure and more subulate bill. That portion of the Linnean *Motacilla*, or rather of the *Sylvia* of Latham, he observes, which Bechstein has separated from the genus under the title of *Accentor*, in conjunction with that which embraces *Sylvia luscinia* [NIGHTINGALE], appears to be the group most nearly approaching the *Thrushes* by the comparative strength of its formation. Here also, perhaps, he thinks we may find the *Hylophilus*, Temm., of the New World, and the IORA, Horsf., of the East, to be united by their stronger bills. Hence, he continues, a number of intervening groups (among which BRACHYPTERYX, and that which includes *Sylvia rubecola*, the *Redbreast*, are specially noticed by him) conduct the inquirer by their gradually lessening bill and more slender form to those birds in which the delicate body, the tapering legs, and the gracile and subulate bill point out their typical supremacy in the

family. To these latter groups he considers *Melizophilus*, Leach, the *Dartford Warbler*, and *Malurus*, Vieill., the representative of *Sylvia* in Australasia (in both of which the bill deviates from that of the conterminous genera in the culmen being somewhat arched), nearly allied, and also the WRENS (*Troglodytes* and *Regulus*, Cuv.). To these he makes succeed a number of groups whose lengthened *tarsi* indicate that their natural station is on the ground, such as *Budytes*, Cuv.; the true *Motacilla* of authors; and *Enicurus*, Temm.; and here he would add *Megalurus*, Horsf., and *Anthus*, Bechst., which unite, in his opinion, the *Dentirostres* with the *Conirostres*, by means of the larks, ALAUDA of authors. [LARKS.] Mr. Vigors then states that *Saxicola*, Bechst., is nearly allied to the larks in its terrestrial habits and general conformation; but which, by its increasing bill, brings us round to the earlier groups of the present family, and thence to the *Merulidæ*, with the section *Saxicoles*, of which it is, he thinks, nearly connected. The circular disposition by which the extremes of different families may be brought into contact with each other, explains, in his view of the case, the manner in which the genus *Saxicola*, the section of *Merles Saxicoles*, the genus *Myiothera*, and the more delicate forms of *Thamnophilus*, all birds decidedly approaching each other, yet belonging to the different families of *Sylviadæ*, *Merulidæ*, and *Laniadæ*, still preserve their union, and are brought together into a conterminous assemblage.

The true *Wrens* display, in his opinion, so close a similarity in their general appearance and habits to *Parus*, Linn., the *Titmouse*, that we may at once acknowledge the affinity between the latter family and the PIPRIDÆ, upon which family he enters by the TITMICE. (*Linn. Trans.*, vol. xiv.)

Mr. Swainson also places the *Sylviadæ* in the dentirostral order. 'The chief peculiarity,' says that zoologist, 'which runs through this numerous family, is the very small size and delicate structure of its individuals. Excepting the humming-birds, we find among these elegant little creatures the smallest birds in the creation. The diminutive goldencrests, the nightingale, the white-throat, and the woodwren, are all well-known examples of genuine warblers, familiar to the British naturalist. The groups of this extensive family, spread over all the habitable regions of the globe, are destined to perform an important part in the economy of nature: to them appears intrusted the subjugation of those innumerable minute insects which lurk within the buds, the foliage, or the flowers of plants; and thus protected, escape that destruction from swallows to which they are only exposed during flight. The diminutive size of such insects renders them unfit for the nourishment of the thrushes and the larger insectivorous birds, while their number and variety only become apparent when the boughs are shaken and their retreat disturbed. How enormous then would be their multiplication, had not nature provided other races of beings to check their increase? No birds appear more perfectly adapted for this purpose than are the warblers.' Mr. Swainson then notices their arrival, for the most part, on the first appearance of spring, when the insect-world is called into life and activity by the renewal of vegetation; and their departure towards autumn, when the insect-hosts diminish, and consequently no longer require the agency of these little birds to keep their numbers within due bounds. He remarks, that as different localities are assigned to different tribes of insects, so a similar diversity of haunts is allotted to the various groups of warblers. Thus the gold-crests and wood-warblers (*Sylvianæ*) confine themselves principally to the higher trees, where they search for winged insects among the leaves, or capture them, like the flycatchers, when attempting to escape. The reed-warblers and the nightingales (*Philomelinæ*) haunt, he observes, the vicinity of waters or the more dense foliage of hedges, for insects peculiar to such situations. The stonechats (*Saxicolinæ*), on the contrary, prefer, he remarks, dry commons and wide extended plains, feeding on insects appropriated to those localities; while those insects which affect humid and wet places are the chosen food of the wagtails and titlarks (*Motacillinæ*); and, lastly, he points out that the *Parianæ*, or titmice, search assiduously among the buds and tender shoots of trees, thus destroying a multitude of hidden enemies to vegetation.

Mr. Swainson thus arranges this family, 'marked by peculiarities of habit no less than by a variation of structure applied to such habits:'—

Circles.	Sylviadæ, or *Warblers*.	[illegible]
1. *Typical.*	Bill very slender, compressed; lateral toes equal.	Sylvianæ.
2. *Subtypical.*	Bill and general structure more robust.	Philomelinæ.
3. *Aberrant.*	Bill depressed at its base; legs lengthened; strong.	Saxicolinæ.
	Claws lengthened, and but slightly curved; live upon the ground.	Motacillinæ.
	Bill strong, almost entire; hinder toe and claw large.	Parianæ.

Of this group the *Motacillinæ*, in Mr. Swainson's opinion, form the most aberrant division. Purely insectivorous, they are, he remarks, well exemplified by the four common and well-known species distributed through this country and Europe generally. 'They live,' says Mr. Swainson, 'almost entirely upon the ground, where alone they seek their food, which consists entirely of insects: damp meadows, and the sides of standing or running waters, are the favourite haunts of these birds; and they run with such celerity, that, in this respect, as well as in their general black and white plumage, they can only be compared to the plovers.' He considers them, in fact, as collectively representing the tenuirostral type of the perchers; or, what is the same, the grallatorial type among birds. [WAGTAILS.]

Mr. Swainson enters among the *Parianæ*, or tits, by the American genus *Seiurus* [TITMICE]; and among the true warblers (*Sylvianæ*) by the genus *Culicivora*, comprising the gnat-snappers. He then treats of the *Philomelinæ*, or nightingale warblers, and concludes his inquiry by an examination of the fifth 'or grallatorial genus,' the *Saxicolinæ*. [WARBLERS.]

The union of all these subfamilies is, in Mr. Swainson's view of the case, effected by the *Gryllivora*, a genus of *Saxicolinæ* uniting to *Enicurus*, which stands at the confines of the wagtails (*Motacillinæ*).

The following genera are comprised under this family, according to Mr. Swainson's arrangement:—

Sylviadæ.

Family Character.—Size universally small. Bill very slender, distinctly notched. Feet formed for walking, perching, or climbing. Tarsus slender, lengthened. (Sw.)

Subfam. *Saxicolinæ*, Stonechats.

Subfamily Character.—Bill depressed at the base: gape with diverging bristles. Feet lengthened. Tail rather short. Head large.

Genera:—*Gryllivora*, Sw.; *Thamnobia*, Sw.; *Saxicola*, Bechst.; *Erythaca*, Bechst. (*Robins*) (with the subgenera *Erythaca*, Sw., and *Sialia*, Sw.); *Petroica*, Sw.

Subfam. *Philomelinæ*, Nightingales.

Subfamily Character.—General structure larger and more robust than the typical warblers. Feet formed for perching.

Genera:—*Phœnicura*, Sw. (*Redstarts*); *Philomela*, Antiq. (*Nightingales*); *Curruca*, Bechst.; *Bradypetus*, Sw.; *Agrobates*, Sw.

Subfam. *Sylvianæ*, True Warblers.

Subfamily Character.—Size very small. Structure weak. Bill very slender, straight, and with the under mandible much thinner than the upper. (Sw.)

Genera:—*Orthotomus*, Horsf.; *Malurus*, Vieill. (with the subgenera *Hemipteryx*, Sw.; *Drymoica*, Sw.; *Melizophilus*, Leach; *Malurus*, Vieill.); *Sylvia*, Lath. (with the subgenera *Sylvia*, *Acanthiza*, Horsf. and Vigors; *Regulus*, Ray; and *Cyanotis*, Sw.); *Culicivora*, Sw.; *Praticola*, Sw.

Subfam. *Parianæ*, Titmice.

Subfamily Character.—Bill either entire or very slightly notched, more or less conic. Tarsus never shorter than the hind-toe, which is large and strong. Lateral toes unequal. (Sw.)

Genera:—*Setophaga*, Sw.; *Sylvicola*, Sw. (with the subgenera *Dumecola*, Sw.; *Sylvicola*, Sw.; *Vermivora*, Sw.; *Mniotilta*, Vieill.; *Zosterops*, Horsf. and Vigors); *Parus*, Linn. (with the subgenera *Ægithina*, Vieill.; *Ægithalus*, Vig.; *Parus*, Linn.; *Parisoma*, Sw.; and *Hylophilus*, Temm.); *Accentor*, Bechst. (with the subgenus *Seiurus*, Sw.); *Trichas*, Sw.

Subfam. *Motacillinæ*, Wagtails.

Subfamily Character.—Bill lengthened; very straight and slender. Legs long, formed for walking. The hind-

too much longer than the rest. Wings pointed. Tail narrow, and much lengthened. (Sw.)

Genera:—*Lessonia*, Sw.; *Budytes*, Cuv.; *Motacilla*, Linn.; *Enicurus*, Temm.; *Anthus*, Bechst.

The family stands between the *Merulidæ* and the *Ampelidæ*. (*Classification of Birds*.)

The *Calamoherpinæ*, *Sylvinæ*, *Saxicolinæ*, *Motacillinæ*, *Parinæ*, and *Sylvicolinæ* are arranged by the Prince of Canino under his family of *Turdidæ*. [MERULIDÆ.]

Mr. G. R. Gray makes the *Sylviadæ* the first family of his third tribe (*Dentirostres*) of *Insessores*, with the following subfamilies:—

1. *Malurinæ*.

Genera:—*Orthotomus*, Horsf. (Edela, Less.); *Prinia*, Horsf.; *Drymoica*, Sw. (*Sylvia*, Lath.); *Cyanotis*, Sw. (*Sylvia*, Vieill., *Tachuris*, D'Orb.); *Regulus*, Gray; *Bradypterus*, Sw. (*Sylvia*, Vieill., *Cysticola*, Less.); *Apalis*, Sw.; *Praticola*, Sw. (*Calamanthus*, Gould, *Anthus*, Vig. and Horsf.); *Cysticola*, Less. (*Salicaria?* Gould, *Sylvia*, Temm.); *Melizophilus*, Leach (*Motacilla*, Gm.); *Hemipteryx*, Sw. (*Sylvia*, Vieill., *Cysticola*, Less.); *Stipiturus*, Less. (*Drymoica*, Sw., *Sylvia*, Lath., *Malurus*, Temm.); *Malurus*, Vieill. (*Motacilla*, Gm.); *Cincloramphus*, Gould (*Megalurus*, Vig. and Horsf.); *Sphenura*, Licht. (*Turdus*, Lath., *Malurus*, Temm.); *Megalurus*, Horsf. (*Malurus*, Reinw.); *Yuhina*, Hodgs. With reference to *Yuhina*, Mr. Gray remarks that it is the same perhaps as the preceding genus.

2. *Sylviinæ*.

Genera:—*Cettia*, Bonap. (*Sylvia*, Marm., *Salicaria?* Gould); *Pseudo-Luscinia*, Bonap. (*Sylvia*, Savi.); *Locustella*, Ray (*Sylvia*, Lath., *Salicaria*, Selby, *Calamoherpe*, Brehm, *Curruca*, Sw., *Arundinaceus*, Less.); *Calamodyta*, Bonap. (*Sylvia*, Temm., *Arundinaceus*, Less.); *Acrocephalus*, Naum. (*Calamoherpe*, Boie, *Motacilla*, Linn., *Salicaria*, Selby, *Curruca*, Sw., *Arundinaceus*, Less.); *Hippolais*, Brehm (*Asilus*, Bechst., *Arundinaceus*, Less., *Motacilla*, Linn.); *Regulus*, Ray (*Motacilla*, Linn.); *Phyllopneuste*, Mey. (*Sylvia*, Lath., *Phylloscopus*, Boie, *Asilus*, Briss., *Trochilus*, Lafr.); *Sylvia*, Lath. (*Philomela*, Sw.); *Curruca*, Briss. (*Motacilla*, Gm., *Sylvia*, Lath.); *Nisoria*, Bonap. (*Curruca*, Brehm, *Philomela*, Sw.); *Luscinia*, Briss. (*Philomela*, Sw., *Daulias*, Boie, *Motacilla*, Gm., *Sylvia*, Lath.).

3. *Saxicolinæ*.

Genera:—*Copsychus*, Wagl. (*Gracula*, Gm., *Gryllivora*, Sw., *Cercotrichas*, Boie, *Lalage* (Boie), Sundev., *Kittacincla*, Gould, *Notodela*, Less.); *Ruticilla*, Ray (*Ficedula*, Bechst., *Phœnicura*, Sw., *Motacilla*, Linn.); *Cyanecula*, Briss. (*Pandicilla*, Bl., *Motacilla*, Linn., *Sylvia*, Lath.); *Calliope*, Gould (*Accentor*, Temm., *Motacilla*, Linn., *Turdus*, Gm.); *Orocetes*, G. R. Gray (*Phœnicura*, Vig., *Petrophila*, Sw.); *Rubecula*, Briss. (*Dandalus*, Boie, *Erythaca*, Sw., *Motacilla*, Linn.); *Sialia*, Sw. (*Sylvia*, Lath.); *Petroica*, Sw. (*Muscicapa*, Gm.); *Origma*, Gould (*Muscicapa*, Lewin., *Saxicola*, Vig. and Horsf.); *Ædon*, Boie (*Erythropygia*, Smith, *Arundinaceus*, Less., *Salicaria*, Gould, *Agrobates*, Sw.); *Thamnobia*, Sw. (Sylvia), *Bessonornis*, Smith; *Campicola*, Sw. (*Sylvia*, Lath., *Saxicola*, Temm.); *Vitiflora*, Briss. (*Œnanthe*, Vieill., *Saxicola*, Bechst., *Motacilla*, Linn.); *Rubetra*, Briss. (*Motacilla*, Linn., *Saxicola*, Bechst.).

4. *Accentorinæ*.

Genera:—*Accentor*, Bechst. (*Motacilla*, Gm.); *Enicocichla*, G. R. Gray (*Seiurus*, Sw., *Turdus*, Will.); *Trichas*, Sw. (*Turdus*, Linn.); *Sericornis*, Gould (*Acanthiza*, Vig. and Horsf.); *Acanthiza*, Vig. and Horsf.; *Psilopus*, Gould; *Symmorphus*, Gould; *Iora*, Horsf. (*Motacilla*, Linn.).

5. *Parinæ*.

Genera:—*Ægithalus*, Vig. (*Remiz*, Cuv., *Pendulinus*, Brehm., *Parus*, Linn.); *Melanochlora*, Less. (*Parus*, Lafr.); *Parus*, Linn.; *Suthora*, Hodgs.; *Minla*, Hodgs.; *Mesia*, Hodgs.; *Bahila*, Hodgs.; *Siva*, Hodgs.; *Megistina*, Vieill. (*Parus*, Gm.); *Tyrannulus*, Vieill. (*Pipra*, Spix. *Sylvia*, Lath.); *Sphenostoma*, Gould; *Calamophilus*, Leach (*Mystacinus*, Boie, *Parus*, Linn.); *Megistura*, Leach (*Orites*, Mœhr, *Paroides*, Brehm, *Parus*, Linn.); *Parisoma*, Sw. (*Sylvia*, Vieill.); *Psaltria*, Temm.; *Ægithina*, Vieill.; *Hylophilus*, Temm.

6. *Sylvicolinæ*.

Genera:—*Sylviparus*, Burt; *Dumecola*, Sw.; *Sylvicola*, Sw. (*Parus*, Linn., *Sylvia*, Lath., *Chloris*, Boie, *Parula*, Bonap.); ———? (*Wilsonia*, Bonap., *Muscicapa*, Wils., *Setophaga*, Sw.); *Vermivora*, Sw. (*Ficedula*, Briss., *Sylvia*, Lath.); *Mniotilta*, Vieill. (*Oxyglossus*, Sw., *Sylvia*, Lath., *Sylvicola*, Jardine); *Zosterops*, Vig. and Horsf. (*Sylvia*, Sw.).

7. *Motacillinæ*. Motacilla, Linn.

Genera.—*Muscisaxicola*, D'Orb. (*Lessonia*, Sw., *Ptionura*, Gould); *Motacilla*, Linn.; *Budytes*, Cuv. (*Motacilla*, Linn.), *Enicurus*, Temm. (*Motacilla*, Linn.; *Turdus*, Vieill.); *Grallina*, Vieill. (*Tanypus*, Oppel.); *Ephthianura*, Gould (*Acanzitha*, J. and S.); *Anthus*, Bechst.; *Corydalla*, Vig. (*Anthus*, Vieill.).

Of these names, *Petrophila* and *Wilsonia* are terms employed in botany.

The *Sylviadæ*, in Mr. G. R. Gray's arrangement, are followed by the *Turdidæ*. (*List of the Genera of Birds*.)

SYLVICAPRA, Mr. Ogilby's name for a genus of Ruminants, placed by him in the family *Bovidæ* [Ox], with the following

Generic character:—*Horns* in the male only. *Maxillary glandules* oblong. *Interdigital fossæ* small. *Inguinal follicles* none. *Teats* four.

Type, *Sylvicapra mergens* (*Antilope mergens*). [ANTELOPE, vol. ii., p. 81.]

SYLVICOLA. [SYLVIADÆ.]

SYLVIPARUS, Mr. Burton's name for a genus of birds combining the characters of *Sylvia*, *Regulus*, and *Parus* in the wing, tail, and bill.

Generic Character.—*Bill* very small, very short, compressed, except at the base; mandibles equal, the upper one a little arcuated at the tip; nostrils covered with setaceous bristles. *Feet* as in the genus *Parus*. *Wings* rather long, extending nearly to the end of the tail; first quill rather short; second, third, and fourth equal, and the longest, the fifth, rather smaller than those, and the sixth equalling the first. *Tail* moderate, equal.

Example, *Sylviparus modestus*.

Description.—Body above brownish-green, below greenish-white; quills and tail-feathers brown; the external pogonia ciliated with yellowish-green. Bill and feet black. Total length four inches.

Locality.—The Himalaya Mountains. (*Zool. Proc.*, 1835.) [SYLVIADÆ.]

SYLVIUS, ÆNEAS. [PIUS II.]

SYMBOLS and NOTATION. The word symbol (from the Greek 'sýmbolon,' σύμβολον) means 'that which is taken with,' and a symbol is a mark which is always attached to some one particular meaning. Notation (*nota*, a known mark) is the method of selecting and assigning meaning to symbols, and the theory of notation (if it yet deserve the name) includes the consideration and choice of symbols, with the formation of rules of selection, so as to take the symbols which are best adapted for the purpose.

This subject might be treated in a very wide manner, for all marks with understood meanings are symbols, from written words to direction-posts. A picture is a symbol, the force of which lies in the resemblance to its object, and many of the earliest symbols must have been pictorial. It is obvious that a general treatment of the subject would hardly be within the power of any one person, and that its extent would be enormous, though it would be desirable to have it discussed in a more general form than has yet been attained, in order that its different parts may receive aid from the rest. Symbols are to the progress of civilization precisely what mechanism is to that of the arts,—not a moving force, perfectly dead in themselves, but capable of being made the medium by which the power is conveyed to its destination, and adapted to its object. They are the instruments of our first thoughts and the originators of new ones. The process by which the earliest symbols called out a yet higher intelligence than that which produced them, which last was again employed in perfecting the symbols themselves, and so on alternately, exactly resembles what has taken place in the mechanical arts. The earliest and rudest tools were first employed to make better ones; and every improvement in the use of force has found one of its best applications in the construction of machinery itself.

We propose in this article to treat particularly of mathematical notation, which, like language, has grown up without much looking to, at the dictates of convenience and with the sanction of the majority. Resemblance, real or fancied, has been the first guide, and analogy has succeeded.

Signs are of two kinds,—1st, Those which spring up and are found in existence, but cannot be traced to their origin; 2ndly, Those of which we know either the origin, or the

epoch of introduction, or both. Those of the first kind pass into the second as inquiry advances. [ALPHABET.] In our present subject we have mostly to deal with the second class.

Mathematical marks or signs differ from those of written language in being almost entirely of the purely abbreviative character, since it is possible that any formula might be expressed in words at length. We say possible, because it is barely so, not meaning thereby to imply that the mathematical sciences could ever have flourished under a system of expressions in words. A well-understood collection of notions, however extensive, becomes simple as a matter of conception by use and habit, and thus becomes a convenient resting-point for the mind and a suitable basis for new combinations of ideas. Now it is the characteristic of the advance of human knowledge that the mind never grapples at once with all that is contained in the notions under use for the time being, but only with some abstraction derived from a previous result, or some particular quality of that result. Hence no symbol which should contain the representative of every idea which occurred in the previous operations would ever be necessary; and more than this, it would even be pernicious from its complexity, as also from its suggesting details which are not required. That generalization, or rather abstraction, which is the distinctive character of the civilized language as compared with the savage (though the latter is not wholly without it), must be the ruling process of mathematical notation, as it is of the advance of spoken language; and in this point of view the connection of our subject with speech presents more analogies and gives more instruction than its comparison with the written signs of speech. The latter is a bounded subject. When once it is agreed how the different modifications of sound shall be represented, written language follows immediately; nor do the infinite modes of using words require any modification of the method of writing them. In our modern works for instance, it would be difficult to find many artifices of notation with which to compare the never-ceasing varieties of mathematical signs. In mentioning the marks of punctuation and reference, the italics for emphatic words, and the varieties of print by which notes are distinguished from text, &c., we have almost exhausted the list.

The greatest purposes of notation seem to be answered when the reader or learner can tell what is meant, first, with the utmost certainty, secondly, with sufficient facility; it being always understood that the second must be abandoned when it clashes with the first. Too much abbreviation may create confusion and doubt as to the meaning; too little may give the meaning with certainty, but not with more certainty than might have been more easily attained. Thus the old algebraists, in using A *quadratum* for A multiplied by A, in their transition from words at length to simple notation, used ten symbols where two only are requisite; and those who first adopted the symbol A A lost no certainty, and gained materially in simplicity. The successors of these again, who employed AA, AAA, AAAA, &c., to stand for the successive powers of A, were surpassed in the same manner by those who adopted A^2, A^3, A^4, &c. Beyond this it is obvious the notation cannot go in simplicity. The symbol which is to represent '*n* As multiplied together' must suggest all three components of the preceding phrase—namely, *n* and A, and multiplied together. In A^n, the *n* and A are obvious, and the position of the letters is the symbol of multiplication; but, on the other hand, those who teach the beginner to signify by A^2 the square described on the line A purchase simplicity at the expense of certainty. The same mathematical phrase with them stands for two different things, connected indeed, but of more dangerous consequence from that very connection; for where similarities exist the reader should not be made to convert them into identities. It is of as much importance to impress the distinction of the things signified, as the analogy of their properties.

Certainty, then, and the greatest facility of obtaining it, seem to be the main points of good notation; and this is true with respect to the learner of all that has gone before. Grant that the mathematical sciences are never to advance further, and many alterations might be made, and many new practices adopted, which would give facility in acquiring the past, without any introduction of obscurity. But the future must also be thought of; and no scheme will merit approbation which enlightens one end of the avenue at the expense of the other. Notation influences discovery by the suggestions which it makes: hence it is desirable that its suggestions should be as many, as plain, and as true, as it is possible. Here we are on quite a different ground: reason is the builder and settler, but imagination is the discoverer; and it might turn out that a notation which suggests many and obvious new ideas, though some of them should be fallacious, would be preferable in its consequences to another of less suggesting power, but more honest in its indications. And while we speak of positive suggestion, it must not be forgotten that a notation may be faulty in occupying the part of the symbol which properly belongs to the extension of another notation. The latter is thus deprived of its natural direction of growth; and must find its way elsewhere, to the injury perhaps of some other part of the symbol. In throwing together a few rules, previously to a little description of the present state of mathematical notation, we do not pretend to have exhausted the list of cautions which the subject requires. It is to be remembered that the language of the exact sciences, instead of being, as should be the case, a separate subject, is hardly ever treated at all, and then only in connexion with some isolated parts of the system. With the exception of an article by Mr. Babbage, in the Edinburgh Encyclopædia, we do not know of anything written in modern times on notation in general. Much may be collected, having notation for its specific object, from the writings of Arbogast, Babbage, Carnot, Cauchy, J. Herschel, and Peacock; writers who all have considered it necessary, when proposing a new symbol or modification of a symbol, to assign some reason for the proposal. In general, however, it is the practice to adopt or reject notation without giving any justification of the course pursued. If it could be rendered necessary, by the force of opinion, that every author should, in making a new symbol, explain the grounds, firstly, of his departure from established usage, secondly, of his choice from among the different methods which would most obviously present themselves,—two distinct advantages would result. In the first place, we should in most cases retain that which exists, until something was to be gained by altering it: in the second, research and ingenuity would have a call into action which does not now exist. We hardly need mention a thing so well known to the mathematician as that the progress of his science now depends more than at any previous time upon the protection of established notation, when good, and the introduction of nothing which is of an opposite character. We should rather say the rate of progress; for, however bad may be the immediate consequences of narrow and ignorant views in this respect, they cannot be permanent. The language of the exact sciences is in a continual state of wholesome fermentation, which throws up and rejects all that is incongruous, obstructive, and even useless. Had it been otherwise, it is impossible that the joint labours of three centuries and many countries, of men differing in language, views, studies, and habits, could have produced so compact and consistent a whole, as, with some defects (though no two persons agree precisely what they are), the present structure of mathematical language must be admitted to present.

The following rules and cautions, with respect to notation, are drawn from observation of the present state just alluded to.

1. Distinctions must be such only as are necessary, and they must be sufficient. For instance, in so simple a matter as the use of capitals or small letters, whatever may guide the inquirer to adopt either in one case should lead him to the same in another, unless some useful distinction can be made by the change. Thus a writer who in one instance uses a capital letter to denote a complicated function of small letters (which is a very desirable mode), will in another part of the same question employ a small letter for a similar purpose, thus nullifying an association of ideas which perspicuity would desire to be retained. If such a course were necessary in the first case, it is still more so in the second. It is not often that the second part of this rule is infringed; so small an addition makes a sufficient distinction, that the principal danger which arises is that of the same notative difference occurring in two varied senses in *different* problems.

The tendency to error is rather towards over-distinction than the contrary. It is surprising how little practice enables the beginner in mathematics to remember that so slight

a difference as that of a and a' implies two totally different numbers, neither having any necessary connexion with the other. The older mathematicians [ACCENT] overdid the use of distinctions in their uniform adoption of different and unconnected letters, and forgot resemblances.

2. The simplicity of notative distinctions must bear some proportion to that of the real differences they are meant to represent. Distinctions of the first and easiest order of simplicity are comparatively few; the complications of ideas of which they are the elements of representation are many, and varied to infinity. There is no better proof of skill than the adaptation of simple forms to simple notions, with a graduated and ascending application of the more complicated of the former to the more complicated of the latter. But some writers remind us in their mathematical language of that awkward mixture of long and short words to which the idiom of our language frequently compels them in their written explanations of the formulæ. For example, if there be two words of more frequent occurrence than any others, they are *numerator* and *denominator*; the parts of a fraction cannot be described under nine syllables. A mathematician will have occasion to write and speak these words ten thousand times, for every occasion on which he will have to use the word *cusp*, of four letters. A comparatively rare idea, used in an isolated subject, can be expressed in one syllable, while the never-ending notions of the parts of a fraction require nine: this he cannot help; but it is in his power to avoid the same sort of inversion in his notation.

3. Pictorial or descriptive notation is preferable to any other, when it can be obtained by simple symbols. Many instances occur in astronomy, and the use of the initial letters of words may be cited as a class of examples: as in f for force, v for velocity, &c.

4. Legitimate associations which have become permanent must not be destroyed, even to gain an advantage. The reason is, that the loss of facility in reading established works generally more than compensates for the advantage of the proposed notation; besides which, it seldom happens that the desired object absolutely requires an invasion of established forms. For instance, perhaps the most uniform of all the notations of the higher mathematics is the use of the letter d to signify an increment which is either infinitely small, or may be made as nearly so as we please. A few Cambridge writers have of late years chosen to make a purely arbitrary change, and to signify by dy, dz, &c., not increments, but limiting ratios of increments: and students trained in these works must learn a new language before they can read Euler, Lagrange, Laplace, and a host of others. Thus $d_x y$ has been made to stand for $dy : dx$, and the old association connected with dy has (in the works spoken of) been destroyed. Now if the letter D had been employed instead, the only harm would have been that the student would have had to learn a new language before he communicated with the greatest mathematicians; as it is, many will have to form a new language out of the materials of the old one, which is a much harder task.

5. Analogies should not be destroyed, unless false: for true analogy has been frequently the parent of discovery, and always of clearness. Thus the real analogy of $\Sigma\phi x\Delta x$ and $\int\phi x dx$ was lost to the eye by the use of $\int_x \phi x$ to signify the latter; an innovation which preceded the one last-mentioned, and has obtained more approbation in this country. The notation used by Fourier to express a definite integral, $\int_a^b \phi x dx$, will certainly prevent the spread of the one just alluded to; though this last itself is chargeable with breach of analogy: for $\int^2 \phi x dx^2$, $\int^3 \phi x dx^3$, &c., ought to represent the successive integrals of $\int\phi x dx$. Fortunately, however, the symbols $(\int dx)^2\phi x$, $(\int dx)^3\phi x$, &c., may represent these successive integrals; and thus the two notations may be combined. For instance, $(\int_0^x dx)^4\phi x$ represents the fourth integral of ϕx, each integration being made from 0 to x.

6. False analogies should never be introduced; and, above all, the incorrect analogies which custom and idiom produce in language should not be perpetuated in notation. It is becoming rather common to make editions of Euclid which are called *symbolical*, and which supply signs in the place of many words. To this, if properly done, there cannot be any objection in point of correctness: nor can we take any serious exception to the use of $\square$AB to stand for the square on AB, to $\|^{l}$ for parallel, $<$ for angle, $\perp^{r}$ for perpendicular, &c. But when we come to AB.BC for the rectangle on AB and BC, AB^2 for the square on AB, we feel the case to be entirely altered. These are already arithmetical symbols: it is bad enough that the word *square* should have both an arithmetical and a geometrical meaning, and causes plenty of confusion: a good notation, if it cannot help in avoiding this confusion, should at least not make it worse. At the same time, with regard to symbolic geometry, we feel some repugnance to introduce it into the elements, from observing that all the best writers seem to feel with one accord that pure reasoning is best expressed in words at length. If it be desirable that a student should be trained to drop reasoning, except as connecting process with process, and to think of process alone in the intervening time, it is also most requisite that he should have a corrective of certain bad habits which the greatest caution will hardly hinder from springing up while he is thus engaged. Arithmetic and algebra amply answer the first end; and geometry, in the manner of Euclid, is the correcting process. Will symbolic geometry do as well? We will not answer positively, but we must say we doubt it.

7. Notation may be modified for mere work in a manner which cannot be admitted in the expression of results which are to be reflected upon. The mathematical inquirer must learn to substitute, for his own private and momentary use, abbreviations which could not be tolerated in the final expression of results. Work may sometimes be made much shorter, and the tendency to error materially diminished, by attention to this suggestion.

For example, the complexity of the symbols,

$$\frac{dz}{dx},\ \frac{dz}{dy},\ \frac{d^2z}{dx^2},\ \frac{d^2z}{dx\,dy},\ \frac{d^2z}{dy^2},$$

greatly impedes the operations connected with problems in solid geometry: the letters p, q, r, s, t, which are often substituted for them, make us lose sight of the connection which exists between the meanings. But the symbols

$$z_x,\ z_y,\ z_{xx},\ z_{xy},\ z_{yy},$$

are not long nor complicated enough to partake much of the disadvantage of the complete symbols, while they are entirely free from that of the isolated letters.

8. In preparing mathematical writings for the press, some attention should be paid to the saving of room. In formulæ which stand out from the text, this is not of so much consequence; but in the text itself a great deal of space is often unnecessarily lost. For example, it is indispensable in formulæ to write a fraction, such as $\frac{a}{b}$, in the manner in which it here appears: but if this be done in the text, a line is lost; and, generally speaking, $a : b$, or $a \div b$, would do as well in mere explanation. Also, in printing, redundancies which are tolerated in writing, should be avoided, such as $\sqrt{7}$, where $\surd 7$ would do as well.

9. Strange and unusual symbols should be avoided, unless there be necessity for a very unusual number of symbols. The use of *script* letters, such as $\mathscr{A}$, $\mathscr{B}$, &c., or old English letters, as $\mathfrak{A}$, $\mathfrak{B}$, $\mathfrak{a}$, $\mathfrak{b}$, &c., except in very peculiar circumstances, is barbarous. A little attention to the development of the resources of established notation will prevent the necessity of having recourse to such alphabets. Nor is it wise to adopt those distinctions in print which are not easily copied in writing, or which it is then difficult to preserve: such as the use of A and A, &c. in different senses; even the distinction of Roman and Italic small letters, a and a, &c., should be sparingly introduced.

10. Among the worst of barbarisms is that of introducing symbols which are quite new in mathematical, but perfectly understood in common, language. Writers have borrowed from the Germans the abbreviation $n!$ to signify $1.2.3\ldots(n-1)n$, which gives their pages the appearance of expressing surprise and admiration that 2, 3, 4, &c. should be found in mathematical results.

The subject of mathematical printing has never been methodically treated, and many details are left to the compositor which should be attended to by the mathematician. Until some mathematician shall turn printer, or some printer mathematician, it is hardly to be hoped that this subject will be properly treated.

The elements of mathematical notation are as follows:—

1. The capitals of the Roman alphabet, and the small letters of the Italic. The small Roman letters and the Italic capitals are rarely used, and should be kept in reserve for rare occasions.

2. The small letters of the Greek alphabet and such capitals as are distinguishable from the corresponding Roman ones, as Δ, Φ, Ψ.

3. The Arabic numerals, and occasionally the Roman ones.

Of all these there should be three different sizes in a good mathematical press, and the different sorts should bear a much better proportion to one another than is usual. The Greek letters seldom set properly with the Roman ones, and few indeed are the instances in which such symbols as

$$a^{m^n} \qquad \varepsilon^{(1+t)^2}$$

are, as they ought to be, good copies of the manner in which they are written. The handwriting of a bad writer is frequently more intelligible to the mathematical eye than the product of the press. Among the faults to which the compositor is naturally subject, and which frequently remain uncorrected by the author, is that of placing blanks or spaces in the manner in which he would do in ordinary matter, by which he is allowed to separate symbols which are in such close connection that absolute junction would not be undesirable. For instance, $\cos\ \theta$ for $\cos\theta$, $(a\ b+c\ d)$ for $(ab+cd)$. As a general rule, the manuscript should be imitated.

4. Accents, superfixed and suffixed, as in $a''\ a_{''}$. These are generally continued, when they become too numerous, by Roman numerals, as in $a_{'}$, $a_{''}$, $a_{'''}$, a_{iv}, a_{v}, a_{vi}, &c.

5. The signs $+\ -\ \times\ \div\ :\ \surd$, and the line which separates the numerator from the denominator. Of these there are generally not sizes enough, particularly as to the sign $-$. It frequently happens that such an expression as $(x-1)(x-2)(x-3)$&c. overruns a line very inconveniently, when the use of a shorter negative sign, as in $(x\text{-}1)(x\text{-}2)(x\text{-}3)$ would avoid such a circumstance altogether. Between the division line of a fraction and the numerator and denominator unsightly spaces very often occur, as in

$$\begin{array}{c}a+b\\ \text{------}\\ c+d\end{array} \text{ instead of } \frac{a+b}{c+d}.$$

6. The integral sign $\int$ with its limits expressed, as in $\int_a^b$: the symbols of nothing and infinity, 0 and ∞.

7. Brackets, parentheses, &c. [ ], ( ), { }, &c. These are often not properly accommodated to the size of the intervening expressions, particularly in thickness.

8. The signs of equality, &c., $=, <>$.

9. Occasionally, but rarely, a bar or a dot is used over a letter, as $\bar{a}$ or $\dot{a}$. In some works, accents and letters are placed on the left of a symbol, as in ${}'a$, ${}^2a$, ${}_2a$. This however should be avoided, as it is difficult to tell to which letter the symbol belongs; and there are ample means of expression in what has been already described.

There are no general rules laid down for the use of notation: a few hints however may be collected from the practice of the best writers of recent times.

1. When a letter is to be often used, it should be, if possible, a small letter, not a capital. The latter species is generally used for functions of small letters.

2. The letters d, Δ, δ, and D, are appropriated for operations of the differential calculus, and should hardly ever be used in any other sense.

3. When co-ordinates are used, the letters x, y, z, must be reserved to signify them; x, y, z, and ξ, η, ζ, may be used if different species be required, and if x', y', z', &c. or $x_{'}, y_{'}, z_{'}$, &c. should not be judged convenient.

4. When functional symbols are wanted, the letters ϕ, ψ, χ, F, f, Φ, Ψ, should be first reserved for them; afterwards ϖ, ω, ⅂, sometimes π, ξ, μ, ν.

5. The letter π is, by universal consent, appropriated to $3{\cdot}14159\ldots$, and ε (by the French e) to $2{\cdot}71828\ldots$; Γ to the functional symbol for $1.2.3\ldots n$.

6. When many operations of differentiation occur, superfixed accents should be avoided in any other sense than that of differentiation.

7. When exponents are wanted to aid in signifying operations, the powers should be carefully distinguished Thus, in a process in which $\sin^{-1}x$ is used for the angle whose sine is x, the square, cube, &c. of $\sin x$ should not be $\sin^2 x$, $\sin^3 x$, &c., but $(\sin x)^2$, $(\sin x)$, &c. Some writers would have the latter notation employed in all cases; but this is, we think, asking a little too much.

8. Greek letters are generally used for angles, and Italic letters for lines, in geometry. To this rule it is desirable to adhere as far as possible, but it cannot be made universal.

9. Suffixed numerals are generally the particular values of some function. Thus a_v means a function of v, of which the values for $v=0$, $v=1$, &c. are a_0, a_1, &c.

10. As to the radical sign, $\sqrt{a}$, $\sqrt[3]{a}$, &c. do not generally mean any one of the square roots, cube roots, &c. of a, but the simple arithmetical root. The indeterminate root is usually denoted by the exponent. Thus $a\pm\sqrt{b}$ may be necessary, but $a\pm b^{\frac{1}{2}}$ has a superfluity.

11. The same letters should be used, as far as possible, in the same sense throughout any one work; and some preceding good writer should be followed. As a general rule, those only are entitled to invent new symbols who cannot express the results of their own investigations without them.

The writer who is most universally acknowledged to be a good guide in the matter of notation is Lagrange. This subject is of great importance; but fortunately it is pretty certain that no really bad symbol, or system of symbols, can permanently prevail. Mathematical language, as already observed, is, and always has been, in a state of gentle fermentation, which throws up and rejects all that cannot assimilate with the rest. A received system may check, but cannot ultimately hinder, discovery: the latter, when it comes, points out from what symbolic error it was so long in arriving, and suggests the proper remedy.

For the progress of mathematical language, see TRANSCENDENTAL: see also SYMMETRY.

SYMA. [KINGFISHERS.]

SYMINGTON. [STEAM CARRIAGE, vol. xxii., p. 187; STEAM-VESSEL, vol. xxii., p. 496.]

SYMMACHUS THE SAMARITAN, so called because he was a native of Samaria, and at first also of the Samaritan religion. He afterwards became a Jew, and then a Christian of the sect of the Ebionites. The time in which he lived is not quite certain, though it is probable that it was in the reign of the emperor Septimius Severus, about A.D. 200.

Although subsequently to the Septuagint two other Greek translations of the Old Testament had been made by Aquila and Theodotion, Symmachus undertook the same task again. His translation differed in many points from those of his predecessors, but it was held in high esteem, and is often referred to by subsequent writers: it is especially praised for the perspicuity and elegance of the style. Symmachus himself published a second and improved edition of it. We only possess a few fragments of this translation, which are printed, together with those of Aquila and Theodotion, in the collections of Morinus Drusius and Montfaucon. Symmachus also wrote a Commentary on the Gospel of St. Matthew, in which he is said to have endeavoured to establish the dogmas of the Ebionites, and also to have attacked Matthew's genealogy of Christ.

(Fabricius, *Biblioth. Graeca*, iii., p. 695, &c.; Schöll, *Geschichte der Griech. Lit.*, ii., p. 301, &c.)

Among the scholiasts on the comic poet Aristophanes there is one whose name was Symmachus; some specimens of his scholia are extant. (Fabricius, *Biblioth. Graeca*, ii., p. 374, n. cc.)

SY'MMACHUS, QUINTUS AURELIUS, the son of L. Aurelius Avianus Symmachus, who was a man of great worth, and in A.D. 365 was prefect of the city of Rome. (Ammian. Marc., xvii. 2; Symmach., *Epist.* i. 38.) The time when his son Q. Aurelius Symmachus was born is uncertain; some would place it as early as the year 314, which is scarcely credible. As he belonged to one of the most illustrious Roman families, his education was conducted with the greatest care. He was instructed in rhetoric by a Gaul, whose name is not known. (Symmach., *Epist.* ix. 86.) In A.D. 370 he was proconsul of Africa, and fourteen years later, A.D. 384, he was prefect of the city, and in 391 consul with Tatianus. The time of his death is uncertain, though it is evident from his writings that he was alive in A.D. 404.

Symmachus was a man of ability and character, and during the difficult and dangerous situations into which he

was thrown by the events of the time, he showed a degree of honesty and prudence which are rarely met with in the history of those times. He was one of the last great bulwarks of paganism, and exerted all his powers to prevent its overthrow, especially during the period of his prætorship of the city. We still possess an address of his to the emperors Valentinianus, Theodosius, and Arcadius (Symmach., *Epist.* x. 61), in which he endeavours to persuade the emperors not to remove the altar of victory from the curia Romana. However, his exertions were fruitless, and his address was refuted by St. Ambrose. His assertion that the Christian religion was the cause of the decline of the empire provoked many Christians of his own and of subsequent times to refute the charge. His partiality for paganism and its superstitions arose from his general attachment to the institutions of his forefathers, and his sincerity in this respect was acknowledged even by his adversaries. During the greater part of his life he was actively engaged in various branches of the administration, but he devoted to study all his leisure time, which he spent in retirement in some of his numerous country seats.

There is extant a collection of letters by him, which was made and published by his son, Q. Flavius Memmius Symmachus, who was prefect of the city in A.D. 415, after the death of his father. The collection consists of ten books; much care has evidently been spent upon the style, and, like all the letter-writers of that time, he took the letters of the younger Pliny as his model. The style is concise and animated, but is far from the natural and beautiful simplicity which characterises the letters written in the better period of Roman history. Yet the letters of Symmachus, especially those of the tenth book, which give a full account of the manner in which he discharged his duties as prefect of Rome, and also contain the above-mentioned address to the emperors, are of peculiar interest in regard to the history, constitution, and administration of the Roman empire. Many points connected with these subjects and with the history of the Roman law would be entirely unintelligible to us without these letters. Symmachus also distinguished himself as an orator, but his orations are lost, with the exception of some fragments. A. Mai discovered fragments of eight orations of Symmachus in a palimpsest of the Ambrosian library at Milan, which he published under the title 'Q. Aurelii Symmachi Octo Orationum ineditarum partes. Invenit notisque declaravit A. Mai,' Mediolani, 1815, 8vo. (Reprinted at Frankfurt, 1816, in 8vo.) Afterwards some other fragments of the orations of Symmachus were discovered in a palimpsest of the Vatican library, which are printed in an appendix to 'Juris Civilis Antejustinianei Reliquiæ ineditae,' &c., cura A. Mai, Romae, 1823, 8vo. These fragments were again increased by Peyron with some new ones from a MS. now at Turin. They are printed in his 'Annotationes ad Inventarium Bibliothecae Bobbionensis,' p. 182, &c. The style of these orations is on the whole the same as that of the letters, and they are equally valuable as historical documents for the history of the empire during the time of Symmachus.

The first edition of the letters of Symmachus appeared at Strasburg in 1510, 4to. This edition however contains only 317 letters, whereas all the subsequent editions contain 965. A complete edition was published at Basel in 1549, 8vo. After this there followed three other important editions: one by Juretus, Paris, 1580, and a second edition, 1604, 4to., with notes; the second by Jac. Lectius, Geneva, 1587, and reprinted 1599, 8vo.; it contains the notes of Juretus with some by Lectius. The third and best edition is that by C. Scioppius, Moguntiae, 1608, 4to. Other editions are that of Philip Pareus, Neapoli Nemetum, 1617 and 1628; reprinted at Frankfurt, 1642, 8vo., and that of Leyden, 1653, in 12mo.

(*Symmachi Vita*, by J. Gothofredus, in the edition of Pareus; Heyne, *Opusc. Acad*, vi., p. 15, &c.; J. Gurlitt, *Susiana in Symmachum*, Hamburg, 1818, 4to.; Fabricius, *Biblioth. Lat.*, iii., p. 204, &c.; A. Mai, in the introduction to his edition of the Orations of Symmachus.)

Besides the three persons of the name of Symmachus mentioned above, there are several others of the same name who lived about or after the time of the one whose name is at the head of this article. L. Aurelius Symmachus was consul in A.D. 330, together with Gallicanus: another of precisely the same name was consul with Aetius, in A.D. 446. Q. Aurelius Memmius Symmachus, perhaps a grandson of the letter-writer and orator Symmachus, was consul in A.D. 485, and was the father of Rusticiana, the second wife of Boethius. (Alcimus Avitus, *Epist.* 31; Ennodius, vii. 25.) His grandson Q. Aurelius Anicius Symmachus was consul with Boethius, the son of the great Boethius, in A.D. 522.

Besides these there are several Latin writers of the name of Symmachus, of whom however nothing is known: 1. Symmachus, the author of an historical work consisting of several books. Jornandes, in his work 'De Rebus Geticis' (c. 15, &c.), quotes a long extract from the fifth book, which relates to the history of the emperor Maximinus. 2. Several poets of the name of Symmachus: one is simply called Symmachus, another Q. Aurelius Symmachus, and a third L. Aurelius Avianus Symmachus. Several epigrams of these poets are still extant.

(Burmann, *Anthol. Lat.*, ii. 143; H. Meyer, *Antholog. Veter. Latin. Epigrammatum et Poemat.*, i., p. 105, &c.)

SY'MMACHUS, a native of Sardinia, and a deacon, was elected bishop of Rome, by part of the clergy, A.D. 498, after the death of Anastasius II., whilst another part of the clergy, supported by several senators, elected a priest called Laurentius. The matter was referred to Theodoric, king of Italy, who decided in favour of Symmachus. The schism however continued for several years, and in the year 500 the partisans of Laurentius rose in arms, and a great tumult took place at Rome, in which much blood was shed, and the virgins consecrated to God were violated. At last Theodoric came to Rome, and convoked a council, A.D. 502, known in church history by the name of 'Concilium Palmare,' in which Symmachus cleared himself of several charges of licentiousness and rapacity, and was confirmed in his see.

Symmachus is said to have condemned the Manichæans, and burnt their books at Rome. He wrote an apologetic treatise, in which he repelled several insinuations against his doctrines, which were put forth by Anastasius I., emperor of the East, and at the same time censured that emperor for the part he had taken in favour of Acacius, the late patriarch of Constantinople, who had opposed the decrees of the council of Chalcedon. Trasmund, king of the Vandals, in Africa, having exiled to Sardinia several African bishops, Symmachus sent them assistance from Rome. Symmachus also repaired and embellished many churches at Rome, founded hospitals, and ransomed many slaves. He died in 514, and was succeeded by Hormisdas.

(Platina and Panvinio, *Vite dei Pontefici*; Bossi, *Storia d'Italia.*)

SYMMETRY, SYMMETRICAL (Mathematics). These terms are now applied to order and regularity of any kind, but this is not their mathematical meaning. Euclid first used the word 'summetros' (σύμμετρος) to signify *commensurable*, and this well known Latin word is in fact merely the literal translation of the Greek: two magnitudes then were symmetrical which admitted of a common measure. In later times, and those comparatively recent, the word was adopted both in geometry and algebra in different senses.

Since symmetrical applies in its etymology to two magnitudes which can be measured together (by the same magnitude), the term would, as to space-magnitudes, naturally apply to those which may be made to coincide. But the term *equal* had occupied this ground; and when, in Euclid, the word equal, which was originally defined in the manner just expressed, had degenerated into signifying equality of area only, the term SIMILAR entered to express sameness of form, so that figures having perfect capability of coincidence, or the same both in size and form, were called equal and similar. The word symmetrical was therefore not wanted, and was finally introduced to signify that obvious relation of equal and similar figures which refers to their position merely, and consists in their corresponding portions being similarly placed on *different sides* of the same straight line; so that coincidence cannot be procured without turning one figure round that straight line. Suppose for instance the front of a building to be *symmetrical*: draw a vertical line through the middle of the elevation, and the two lateral portions are equal and similar, as Euclid uses those words. But they are more than equal and similar; they are symmetrical: the right-hand side stands in the right-hand portion of space, with respect to the dividing line, and in exactly the same manner as the left-hand side stands in the left-hand portion of space. If the architect were to preserve equality and similarity, without symmetry, he would make two left sides, or two right sides, to his building, but not one right and one left. In the letter W there is a want of symmetry, but not in O: to make W symmetrical both the inner lines should be thin, and both the outer ones thick.

Euclid assumes the power of turning a plane round, so as to apply the faces of two figures to one another, in such manner that, after the application, the spectator must be supposed to see through the paper or other imaginary substance of which his plane is the surface. He has then no occasion to consider symmetricality; that is, figures being equal and similar, no cases can arise in which it makes any difference of demonstration whether they are symmetrical or not. When he comes to solid figures, he assumes a postulate in the garb of a definition, which dispenses him from the consideration of symmetry: namely, that solid figures consisting of the same number of equal planes, similarly placed, are equal. He seems to imagine that such solids must evidently be capable of being made to occupy the same space, which, though true as to quantity of space, is not true as to its disposition. Two solids may be equal in every respect, and yet it may be impossible (and precisely on account of their symmetry) to make one occupy the space previously occupied by the other. The two hands furnish an instance: they give the idea of equality (of size), similarity (of form), and symmetry (of disposition). Yet they cannot be made to occupy the same space, so as for instance to fit exactly the same glove; and a sculptor who should cast both hands from the same mould, would be detected immediately as having given his figure two right hands or two left hands. Again, suppose two solids, irregular pyramids for instance, composed of planes similar and equal, each of one to one of the other. Let coincidence be attempted geometrically: the two bases must of course be made to coincide. If then the two vertices fall on the same side of the common base, the figures will coincide altogether; but if the two vertices fall on opposite sides of the bases, absolute coincidence is impossible. Legendre proposed to call such solids by the name of *symmetrical*, in doing which he introduced the term of common life in an appropriate manner.

In algebra, a function is said to be symmetrical with respect to any two letters when it would undergo no change if these letters were interchanged, or if each were made to take the place of the other. Thus

$$x^2 + a^2x + ab + b^2x$$

is symmetrical with respect to a and b; interchange would give

$$x^2 + b^2x + ba + a^2x,$$

the same as before. But this expression is not symmetrical with respect to a and x, for interchange would here give

$$a^2 + x^2a + xb + b^2a.$$

An expression is symmetrical with respect to any number of letters when any two of them whatsoever may be interchanged without alteration of the function. Thus $a^2b+ba^2+a^2c+ca^2+b^2c+bc^2$ is symmetrical with respect to a, b, and c. It is not sufficient that certain contemporaneous changes should be practicable without producing alteration: *any two* must be interchangeable, the rest remaining. Thus $a^2b+b^2c+c^2a$ is unaltered if a become b, b become c, and c become a, at the same time, but it is not symmetrical: for if a and b only be interchanged, it becomes $b^2a+a^2c+c^2b$, or is altered.

Attention to *symmetry* is of the utmost consequence in mathematical notation. Here the word means that quantities which in any manner have a common relation should have something common in the symbols of notation; and analogy is perhaps a better word than symmetry. Suppose, for instance, we had taken, for the equation of a SURFACE OF THE SECOND DEGREE, $ax^2+by^2+cz^2+dxy+exz+fyz+gx+hy+kz+l=0$. Our formulæ would have been confused masses of letters, no set of which would have presented any similarity, or have easily remained in the memory. But in the article cited there is no set of formulæ of which more than one need be remembered; the others must be suggested by it.

SYMMORPHUS, the name given to a new genus of birds by Mr. Gould, who seems to be uncertain as to the family in which it should be placed.

Generic Character.—Bill rather short, tumid; the upper mandible slightly notched at the tip; the culmen and commissure subarcuate; the nostrils basal, oval, and nearly hidden by the frontal feathers. *Wings* moderate: first quill shorter than the second by one-half; third, fourth, and fifth longest and nearly equal. *Tail* moderate, the external tail-feather on each side shorter than the rest by one-fourth. *Tarsi* and *feet* moderate, the former scutellated anteriorly; the posterior toe with its claw shorter than the middle one, the two lateral toes unequal, the inner shortest.

Example, *Symmorphus leucopygus.*

Description.—The loro blackish-brown; the supra-ocular line fawn-white; the top of the head, nape, and back intensely rufous-brown; shoulders, tips of the greater wing-coverts, rump, throat, and body below white obscurely margined with chestnut; four middle tail-feathers brown, ashy-white at the tips, the three external ones on each side form the base half-way down brown, the rest white. Bill and feet black. Total length 7⅜ inches.

Locality.—New South Wales. (*Zool. Proc.*, 1837.)

SYMPATHETIC NERVES. [NERVE AND NERVOUS SYSTEM.]

SYMPATHETIC SOUNDS. The purposes of the reference made to this article from ÆOLIAN HARP have been answered in HARMONICS. These harmonics are the sympathetic sounds alluded to. The term was also applied to sounds produced in one instrument by sounding another close to it. [ACOUSTICS, p. 90.] When one instrument is made to sound close to another, not only are the vibrations of the latter felt, as in the experiment alluded to, but sometimes heard. This, which was once attributed to sympathy, is now of course explained by the communication of motion from one instrument to the other through the medium of the intervening air. [VIBRATION.]

SYMPATHY. [NERVE AND NERVOUS SYSTEM.]

SYMPHONY (*σύν, with*, and *φωνή, sound*), a term very differently understood at different periods of musical history. Some writers, according to Zarlino (Parte 3za, cap. lxxix.), have considered it as an instrument of the lyre kind. Others have thought it a sort of drum. If an instrument, that it was used as an accompaniment—most probably to the voice—the word in its original signification leads us naturally to conjecture.

With the moderns, Symphony, or *Sinfonia*, signifies a musical composition for a full band of instruments, and, up to the latter part of the last century, the word was synonymous with overture; symphonies, and among these several of Haydn's early ones, having been called overtures. Even at the present day the overture in the composer's score of an Italian opera is usually termed *Sinfonia*. The modern symphony generally consists of four movements: a brilliant allegro, which is commonly preceded by a slow introduction; an expressive adagio or andante; a minuet with its trio; and a finale. Instead of the minuet, what is called a *Scherzo*, a short, animated, sportive movement, is sometimes substituted. But composers are not restricted by any rule regarding the number of movements. Mozart's second symphony in D has but three, besides the slow introduction; while Beethoven's Pastoral and Choral symphonies may be said to comprise six or more.

Symphony is a term also applied to the instrumental introductions, terminations, &c. of vocal compositions; and these are sometimes called ritornels, from the French *ritournelle*, or the Italian *ritornello*.

SYMPHORICARPOS (from *συμφόρεω*, to bring together, and *καρπός*, fruit), or **SYMPHORIA**, the name of a genus of plants belonging to the natural order Caprifoliaceæ. The tube of the calyx is globose, with a small limb, and 4-5-toothed; corolla funnel-shaped, 4-5-lobed; stamens 5; ovary 4-celled with simple style and semiglobose stigma, the fertile cells containing one ovule, sterile ones several; fruit a berry, having 4 cells, 2 of which contain single seeds and 2 are empty. The species are natives of North and South America. They are elegant, bushy, oppositely-branched shrubs with oval entire leaves, small white or rose-coloured flowers with short pedicels, seated on one or many-flowered peduncles, and furnished with two bracts.

S. vulgaris, common St. Peter's-wort: flowers disposed in axillary, capitate clusters, and seated on very short pedicels. It is a native of Pennsylvania, the Carolinas, and Virginia, in sandy dry districts. It bears red cup-shaped berries, which are about the size of a hempseed, and ripen in winter. It grows to the height of from 3 to 6 feet, and flowers in August and September.

S. racemosus, Snow-berry: flowers disposed in loose, often leafy, interrupted racemes; corolla bearded internally; stamens and style included. It is a native of North America, and grows on the banks of the Missouri, in Upper Canada, and on the north-west coast at Paget's and Nootka sounds. This is a very handsome shrub, and was introduced into our gardens in 1817, since which time it has become very common. It has rose coloured flowers, with entire leaves glaucous beneath. The fruit is about the size of a small cherry, and quite white, remaining on the tree after the leaves have dropped off, and giving it a very

beautiful appearance. It throws up very numerous suckers, and on this account may be troublesome in small gardens; but for shrubberies it is a very desirable plant, as bees are very fond of its flowers, and game will feed on its berries. It blossoms from July to September.

S. Occidentalis, Wolf-berry, Western St. Peter's-wort: flowers in spikes, dense, terminal, axillary, and drooping; style and stamens protruded. It is a native of British North America, and is abundant about the Saskatchevan and Red River. It is a shrub from 4 to 6 feet high, and has the same general characters as the last, but has not yet been cultivated in Great Britain.

S. microphyllus and *S. glaucescens*, the remaining species, are natives of Mexico. All the species are easily cultivated, and grow in any common garden-soil. They may be best propagated by cuttings, which may be planted in either spring or autumn.

SYMPHYNO'TA. [NAIADES, vol. xvi., p. 66.]

SY'MPHYTUM (from σύμφυτον, a name for a plant employed by Pliny and Dioscorides), the name of a genus of plants belonging to the natural order Boraginaceæ. It has a 5-parted calyx; a cylindrical-campanulate corolla, the throat of which is furnished with 6 subulate, vaulted processes which connive to form a cone; 4 1-celled ovate nuts fixed at the base of the calyx, imperforate. The species are rough herbaceous plants with broad leaves and terminal twin racemes of flowers. They are natives chiefly of Europe and Asia.

S. officinalis, common Comfrey: fusiform-branched roots; branched stem, leaves decurrent, the upper ones lanceolate, the lower ovato-lanceolate, scabrous above and hairy beneath; limb of the corolla 3-toothed, with the teeth recurved; the anthers twice the length of the filament. It is an inhabitant of the banks of rivers and streams and watery places throughout Europe. 'Comfrey root,' Woodville observes, 'abounds in a tasteless mucilage like that of the marsh-mallow; and being more easily obtained, it ought not to be omitted in lists of medicinal plants. Such medicines are useful in irritations of the throat, intestines, and, above all, the bladder.' The flowers are of a yellowish-white colour. A variety not uncommon in Scotland and the Continent has bluish-purple flowers, red before expansion: it was called by Sibthorp *S. patens*. *S. Bohemium* is also a variety of this species. It has red or reddish-purple flowers.

S. tuberosum, tuberous-rooted Comfrey: rhizoma oblique, thickened by scales, furnished with short branches; leaves partly decurrent, upper ones elliptical, lower ones ovate; corolla tubulose, funnel-shaped, 5-toothed; teeth recurved. This plant is not so stiff and hairy as the last. It is a native of Germany, Austria, France, Spain, and Italy. It has also been found in Scotland, near Edinburgh, and in Durham in England. Its flowers are of a yellowish-white colour, and appear in April and May.

S. asperrimum, rough Comfrey: stems branched, covered with tubercles; leaves ovate, heart-shaped, pointed, running into petioles, hairy above, strigose beneath, upper ones opposite, subsessile; calyx tuberculated, acute; limb of corolla campanulate. It is a native of the Caucasus and grows on the banks of streams and rivulets. It is a tall plant, very rough, with handsome flowers, which are red before expansion, and afterwards blue.

There are several other species. They are all hardy plants, and are well adapted for border-flowers in gardens, or for woods and shrubberies, as they will flourish under the shade of trees and shrubs. They will grow in almost any soil, and may be readily increased by dividing their roots in the spring.

SYMPLECTES, Mr. Swainson's name for a subgenus of the genus *Ploceus*. [FRINGILLIDÆ; WEAVER-BIRDS.]

SYMPLECTOME'REA. [FORAMINIFERA.] N.B.—M. Dujardin's name for the class is *Rhizopoda*.

SY'MPLOCOS (from συμπλοκή, a knitting together), the name of a genus of plants belonging to the natural order Styraceæ. This genus was made the type of a natural order, Symplocineæ, by D. Don, which contained only this example. It has a 3-parted half-inferior calyx; rotate monopetalous 5-10-parted corolla, imbricate in æstivation; indefinite stamens inserted in the lobe of the corolla, with the filaments cuspidate at the apex, and polyadelphous at the base; erect anthers bursting longitudinally; 3-5-celled ovary with 4 ovules in each cell. The fruit is a fleshy drupe, containing a 3-5-celled nut; the cells containing but one seed, which has an inverted embryo lying in albumen, and a superior radicle. The species are trees, having alternate, either entire or serrated, leaves without stipules, and turning yellow in drying. The flowers are axillary, sessile, or pedunculate, few, of a white or scarlet colour, and supplied with bracteas at their base. Upwards of 30 species have been described. They all possess an astringent principle in their leaves, and some are used in dyeing.

S. Alstonia, Alston's Symplocos, is the *Alstonia theæformis* of Linnæus, and was named after Charles Alston, professor of botany in the University of Edinburgh. The plant is glabrous in every part, and has shining coriaceous roundish-elliptic or oblong leaves, obtuse, rounded at the base, and obscurely crenated at the apex; sessile flowers arranged in threes and fours. It is a native of New Granada, near Santa Fé de Bogota, and Popayan.

S. tinctoria, Dyer's Symplocos, Sweet-leaf, Yellow-leaf: leaves oblong or lanceolate ovate, serrated, glaucous, shining; flowers axillary, 8 or 16, together. This plant is the *Hopea tinctoria* of Linnæus, and is a native of the Carolinas in the United States of America.

S. racemosa, racemose-flowered Symplocos: leaves oblong, glabrous, serrated; flowers arranged in racemes, mostly axillary; nut of fruit 3-celled. This plant is a native of Burdwar and Midnapore, in Bengal. It is used extensively by the natives as a dye, which is of a red colour.

The nuts of *S. spicata* are very hard, and resemble a little fluted pitcher. This plant is a native of Silhet.

In their cultivation they grow best in a soil composed of a mixture of loam, sand, and peat; and are best propagated by cuttings, which grow freely in sand under a hand-glass.

SYMPTOM (σύμπτωμα, an incident, or coincidence) is any change in the appearance or functions of the body different from those which occur in health, and perceptible to the senses either of the patient or his physician. Symptoms must not be confounded with signs of disease. The observation of facts by means of our senses renders us acquainted with symptoms, but it is by medical reasoning thereupon that we deduce signs. A patient often knows his own symptoms, but is nevertheless ignorant of the disease under which he labours.

The signs of disease are inferences drawn by the mind from the observation of symptoms. The most striking symptoms often furnish only accessory signs, while the most obscure are the signs characteristic of the disease. Violent pain in the head not unfrequently attends inflammation of the lungs, but is a symptom of very small importance, while slight pain in the side, or a streak of blood in the expectoration, furnishes a very valuable sign, and helps to disclose the nature of the affection.

Symptoms are best divided into the *essential*, which are peculiar to certain diseases, the *accidental*, produced by some circumstance of unusual occurrence, and the *common*, which are met with alike in various complaints.

That part of medicine which treats of symptoms is called Symptomatology: Semeiology is the name applied to the investigation of the signs of disease, and of their comparative value.

SYNAGOGUE (Συναγωγή), a word which primarily signifies any assembly or congregation, but came, like the word 'church,' to be applied, among the Jews, to places where any assemblies, especially those for the worship of God, met, or were convened. In the later Hebrew, such places were called בֵּית כְּנֶסֶת, 'house of assembly.' There is no trace of synagogues among the Israelites prior to the Babylonish captivity, nor, in express terms, until a long time after. It is collected however that the origin of such establishments may be referred to that period. Being then debarred from their customary religious observances, they were accustomed to assemble on the Sabbath-day, to hear portions of the law read and expounded; and those who ultimately returned from exile kept up this custom in Palestine. (*Nehem.*, viii. 18.) These assemblies or meetings became in due time fixed to certain places, and a regular order was observed in them. They existed considerably earlier among the Jews settled in foreign parts than in their own country, where we do not find them until the time of the Asmonæan princes; but after their introduction they increased rapidly. The synagogues appear to have been originally erected outside the towns, in the fields, usually near waters, for the convenience of ablution; but they were soon introduced into the towns, and were usually on the most elevated spots. In large towns there were several, and the Jewish writers affirm that there were 480

in Jerusalem. The assemblages were at first confined to the Sabbath-days and festivals, but were latterly extended to the second and fifth days of the week (Mondays and Thursdays). The services consisted chiefly in prayer, and in the reading and exposition of the sacred books. At first the readings were confined to the law, but were at length made to comprehend portions of the prophets, psalms, and other books. The whole concluded with a prayer and benediction, to which the congregation responded 'Amen.'

It seems to have been the custom for a synagogue not to be opened in any place where ten men could not be found of sufficient leisure to attend to its affairs. Where no separate building existed, a room in some private house was the place of meeting. There are no antient indications that the synagogues had any peculiar form; but each of them had a kind of altar or table, at which the volume of the law was read; and at the east end was an ark or chest in which that volume was kept. The seats were so disposed that the face of the people was turned towards this sacred repository and towards the elders, who alone sat with their backs to the ark, and their faces to the people. The synagogues were used not only for worship, but for holding local courts of justice, which had cognizance of petty offences requiring no higher punishment than stripes, which were inflicted on the spot. (*Matt.*, x. 17; *Luke*, xii. 11; *Acts*, xxii. 19.) The affairs of the synagogue were under the direction of several officers: the chief of them was the archisynagogus (ἀρχισυναγωγός), or 'ruler of the synagogue,' who regulated its affairs, and without whose leave no one could read or preach. (*Mark*, v. 22; *Luke*, xiii. 14.) Next to him was the officer called שליח צבור 'Sheliach tzibbor,' or 'angel (messenger) of the church,' who prayed in behalf of the congregation. The חזן 'Chazan,' who is the reader in modern synagogues, appears to have been the 'minister' (*Luke*, iv. 20) who had charge of the sacred books. As it appears from *Acts*, xiii. 15, that there were several archisynagogi, it is probable that they answered to the committee of elders, by whom the synagogues are at the present time managed.

With some necessary modifications, the antient usages are still maintained in the modern synagogues. The highest ground that can be conveniently appropriated is still chosen for the site of a synagogue. In this part of the world it extends east and west, with the entrance, or principal entrance, in the west, that as the people enter, and as they sit, their faces may be turned towards the land of Canaan. The altar or desk is on a raised platform surrounded by a wooden rail, and large enough to contain several persons: the women do not mingle with the men, but have a separate part or gallery (if there be one), where a wooden lattice screens them from observation. The men keep their heads covered in the synagogues.

The first synagogue in England of which we have historical knowledge is that which, in the reign of William Rufus, existed at Oxford, where the Jews were then numerous; but it is likely that they had one then or before in London also, as the fact that their only burial-place in England was in the spot now called Jewin Street, indicates that this was their principal seat. Early in the reign of Henry III. the Jews ventured to build in London a synagogue, which surpassed all the churches of that city in stateliness; and this occasioned its being taken from them, and consecrated to the Blessed Virgin. Later in the same reign they lost another synagogue, which they had erected in the Old Jewry, on the complaint of the Friars Penitent in the neighbourhood, that they could not consecrate the elements in quiet on account of their 'howlings.' So late as the reign of George II. the only synagogues allowed in England were the two in London, one for the Portuguese Jews in Bevis Marks, and the other for the German Jews, in Duke's Place. But this restriction has long been withdrawn, and there are now seven or eight synagogues in London, and one in most of the seaport towns.

(Vitringa, *De Synagoga* and *Archisynagogus;* Lewis, *Origines Hebrææ;* Tovey's *Anglia Judaica;* Allen's *Modern Judaism.*)

SYNALLAXIS, M. Vieillot's name for a genus of birds, placed by Mr. Swainson in the family of *Certhiadæ*.

Generic Character.—Bill short, rather strong, straight; both mandibles of equal thickness, entire, and much compressed; the margins of the upper mandible inflexed beyond the nostrils. Frontal feathers rather rigid. *Wings* very short, and much rounded; the primaries scarcely exceeding the tertials. *Tail* broad, more or less lengthened, and either graduated or cuneated; the webs soft and loose, but the shafts rather rigid; the tips lanceolate. *Feet* very large. Tarsus lengthened. Middle toe longer than the hinder; lateral toes equal. Claws slender, acute, and but slightly curved; the three anterior rather small. (Sw.)

Example, *Synallaxis garrulus.*

Description.—Brown, beneath whitish, feathers on the front of the head rigid, pointed, and rufous; lines before and behind the eye whitish; tail moderate, rounded.

Habits, &c.—Mr. Swainson, whose description this is, has given a very good figure of this bird under the name of *Malurus garrulus*, in the first series of his *Zoological Illustrations*. It is remarkable, he observes, for its very singular nest, which is so large as to form a feature in the woodland scenery of Bahia, the only part of Brazil where he observed it. He describes the nest as built in low trees, formed externally of dried sticks, without any neatness, usually three or four feet long, and resembling at a distance a thick twist of bean-stalks thrown in the branches by accident. Sometimes, he says, two of these nests appear as if joined together, and there is an opening on the side, besides one at the top. He further states that the sexes are generally seen near the nest, uttering a shrill, incessant, monotonous chirp, particularly in the morning and evening, adding (and we respect him for it) that he never could bring himself to tear one of these nests to pieces, merely for the purpose of seeing its construction.

Synallaxis garrulus (reduced from Mr. Swainson's figure).

Nest in tree (after the same).

SYNCELLUS (σύγκελλος), a Greek word equivalent to *concellaneus* in Latin, and meaning a person who inhabits the same chamber (*cella*) with another, was used by the Christians of the early and middle ages as the name of an ecclesiastical dignity. The Syncellus was constantly with the patriarch, metropolitan, or bishop, as an inspector of his life and manners. The successors to the patriarchs and metropolitans were very often chosen from the Syncelli. Their rank was very high, and at one time they even claimed precedence over the metropolitans. Their number was considerable, till by a constitution of Heraclius the greatest number allowed in one church was two.

The chief of the Syncelli was called Protosyncellus (πρωτοσύγκελλος), and the president of their assemblies was called πρωτοπρόεδρος τῶν πρωτοσυγκέλλων.

The suffragan bishops [BISHOP] were also called Syncelli.

(Du Cange, *Glossar. Med. et Inf. Latin.*, s. v. 'Syncellus;' *Glossar. Med. et Inf. Graecit.*, s. v. Σύγκελλος.)

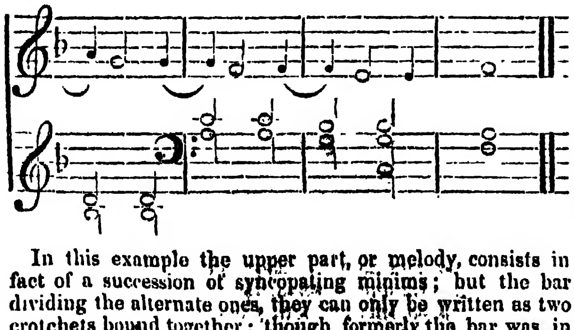
SYNCELLUS, GEORGE (Γεώργιος Σύγκελλος) was a monk and abbot at the end of the eighth and the beginning of the ninth century after Christ. His surname was given him from his being the *Syncellus* of Tarasius, patriarch of Constantinople, who died in the year 806 A.D. George Syncellus died about the year 800.

His 'Chronography' (ἐκλογὴ χρονογραφίας) is a history of the world, arranged in chronological order, from the creation to the reign of Diocletian. The intention of the writer was to include the whole period down to 800 A.D. It is little more than a copy of the 'Chronicon' of Eusebius.

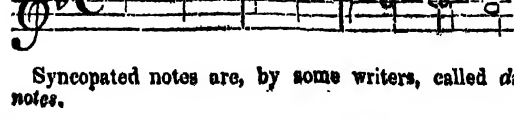
It was published from a MS. in the royal library at Paris, which was obtained at Corinth in 1507, by Jac. Goar, in a folio volume, containing the Greek text, a Latin version, and notes, together with the 'Breviarium' of Nicephorus, Paris, 1652, reprinted at Venice, 1729. It is also contained in the Bonn collection of the Byzantine writers, in which it forms, with 'Nicephorus,' two volumes, edited by W. Dindorf, from two important MSS. at Paris, 1829. The Chronography of Syncellus was continued by Theophanes from 285 to 813 A.D. Among the MSS. of the Royal Library at Paris are fragments of other historical works ascribed to Syncellus.

(Fabricius, *Biblioth. Græc.*, vii., p. 457, ed. Harles; Schoell, *Geschichte der Griech. Lit.*, iii., p. 253.)

SYNCOPATION, in Music, is when the first half of a note begins on the unaccented or weak part of a bar, and the other half is continued and terminates on the accented or strong part. [ACCENT, *in Music*.] Example:—



In this example the upper part, or melody, consists in fact of a succession of syncopating minims; but the bar dividing the alternate ones, they can only be written as two crotchets bound together; though formerly the bar was, in most cases, made to cut the note in two. Example:—



&c.

Syncopated notes are, by some writers, called *driving notes*.

SY'NCOPE (συγκοπή, literally a cutting in pieces, a sudden failure of power or strength), fainting. A sudden impairment or complete loss of sensation and voluntary motion, with great diminution or almost total abolition of the heart's action and of the function of respiration.

Fainting sometimes occurs quite suddenly, but is usually ushered in by certain premonitory symptoms. These are a sense of languor and uneasiness, confusion of the mind, oppression at the chest, dimness of sight, ringing in the ears, partial cold sweats, paleness of the face, and coldness of the extremities. These continue for some time, and then either pass away, or are followed by swooning, a state of complete faintness, during which the pulse is altogether imperceptible at the wrist, and respiration nearly ceases. When a fainting fit comes on suddenly and without any warning, it is usually more profound than when it has been preceded by the symptoms just enumerated. Recovery from fainting is frequently attended with palpitation of the heart, and sensations more distressing than those which ushered in the attack. The duration of a fainting fit seldom exceeds a few minutes or even seconds, but instances are on record of persons continuing in a swoon for many hours.

The immediate cause of fainting is in all instances some interruption to the due transmission of blood to the brain. Various circumstances however, both moral and physical, interfere with the circulation, either through the medium of the nervous system, or by acting directly on the heart itself. Persons swoon from any violent and sudden moral emotion, as terror, grief, disappointment, or even excessive joy. The sight of blood or of any object which excites disgust occasions some persons to faint, as do various impressions on the senses, whether painful or otherwise. Very susceptible individuals have been known to faint on perceiving the odour of certain flowers, and unpleasant smells still more frequently cause faintness. Long watching or over exertion, blows on the pit of the stomach, swinging, and rotatory motions are some among many of the conditions which occasion fainting by their action on the nervous system. The abstraction of a large quantity of blood probably has a more immediate action on the heart; and to the disturbance of the circulation must be attributed those fainting fits which sometimes occur in the course of diseases of the heart. The sudden transition from a horizontal to a sitting posture when persons are very weak or have lost a large quantity of blood probably acts in both ways at once; and fainting sometimes takes place from other causes, such as heated rooms, &c., of which we cannot well explain the action.

Fainting may be confounded with apoplexy or asphyxia; and if it continues for an unusually long time, the person may be supposed to be dead. A little attention however will prevent our mistaking an apoplectic person, who breathes loudly and with a snoring noise, for a person in a swoon, whose respiration is gentle, and almost imperceptible, and whose pulse either cannot be felt at all, or is at any rate extremely weak. Asphyxia is a state of suspended animation, brought on by some cause interfering directly with respiration: it is marked by tumor and lividity of the face, while the face of a person in a fainting-fit is pale and sunken. The continuance of respiration and of the heart's action, though very feebly, the temperature of the body, and the absence of all stiffness of the limbs, would sufficiently distinguish syncope from death; but it must be very unusual for fainting to continue for a few minutes without there appearing some evident sign of life.

In the treatment of a person who has fainted, the first point is to place him in the recumbent posture; and in the case of fainting after blood-letting, nothing more is in general required. Exposure to the cool air, sprinkling cold water on the face, and friction of the limbs, may be employed if the fit continues; and a small quantity of æther or sal-volatile may be given as soon as the person can swallow. The horizontal posture should be preserved until recovery is complete.

For the prevention of fainting-fits in those who are subject to their frequent recurrence, various treatment must be necessary, according to the nature of the cause producing them. Slight fainting-fits recurring frequently are a common forerunner of epilepsy.

SYNDA'CTYLES, or SYNDACTYLOUS BIRDS, a group comprehending those birds which have the external toe nearly as long as the middle one, and united to it as far as the penultimate articulation. This group contains the

bee-eaters (*Merops*, Linn.), the motmots (*Prionites*, Ill.), the king-fishers (*Alcedo*, Linn.), the todies (*Todus*, Linn.), and the hornbills (*Buceros*, Linn.).

SYNDIC comes from the Greek 'syndicos' (σύνδικος). The Greek word Syndicos originally signified one who aided another in a matter before a court of justice, and hence it came to signify generally an advocate, one who maintained another's cause before a court of justice. Syndicos also signified at Athens one who was appointed by the state to attend to its interests in any matter in dispute between Athens and another state: thus Æschines was elected their Syndicus by the Athenians in a matter relating to the temple at Delos. (Demosthen. Περὶ Στεφάνου, c. 42.) There were also functionaries at Athens called Syndici, who were appointed, after the establishment of the tyranny of the Thirty, to decide on cases of confiscated property. The word Syndicus passed into the Latin language. It often occurs in the 'Digest' in the sense of an attorney or agent for a university or corporate body: in this sense it is used as synonymous with Actor by Gaius. (*Dig.* 3, tit. 4, s. 1.) In the middle ages also the word Syndicus was in common use, and was frequently given to the agent or factor appointed by corporate bodies to manage their common affairs, and especially to represent them in courts of law. Thus, in the year 1203, the university of Paris sought and obtained permission from Pope Innocent III. to appoint an officer for such purposes with this name. (Bulaei *Hist. Univ. Paris.*, iii. 23; Crevier, *Hist. de l'Univ. de Paris*, i. 284.) Crevier, in various places, designates the syndic of the university, or of the faculty of arts, by the equivalent names of procureur, agent, greffier (iii. 230; iv. 309; v. 459). In the same sense most of the other corporate bodies in Paris and other French towns used to have their syndics; and the syndic was also the usual name for the solicitor to the community, or town-clerk, in the towns of Languedoc and Provence. The clergy, in like manner, had their Syndics Généraux, Syndics Diocésains, and Syndics Provinciaux; and Syndics, or agents resident at Paris, were also appointed by most of the religious orders. (*Encyclopédie*, and Richelet, *ad verb.*) The functions of the different syndics however varied considerably; some were mere agents or solicitors, others were representatives of their corporations in a higher sense, sometimes acting as their presidents, and deciding causes, instead of merely conducting them. The syndics in some places were much the same description of functionaries that were elsewhere called Scabini or Echevins, a species of town-councillors or magistrates. At Marseilles, in the fourteenth century, four magistrates were elected every year to manage the military affairs of the city, who were designated Syndici de Guerra. (Ducange, *Gloss. Med. et Infim. Latin.*, *ad verb.*) The four chief magistrates of the city of Geneva, also annually elected, used to be called Syndics. Among the Burdegalenses (or people of the district of which Bordeaux is the capital), the office of Syndic, supposed to have meant originally the defender of a military post, became in course of time an hereditary title of nobility: thus, in Froissart, and other chroniclers of the fourteenth century, we read of the Syndic, or Soudic (in Latin, Soldicus), d'Estrades, and the Soudic, or Soudich, or sometimes Soudan (as if the word had become confounded with the Arabic *Sultan*), de la Trau, or de Trau, or de Trabe, or de Laitrau. In more recent times, when Louis XIV., in 1701, directed the establishment of chambers of commerce in the principal towns of France, the merchants and other persons composing them were appointed to be called Syndics du Commerce, or Syndics de la Chambre de Commerce. For the significations of the various old words derived from or connected with Syndicus (otherwise Sindicus, Scindicus, Scyndicus, Sindictus), such as Syndicare, Syndecari, Sindicamentum, Sindicatio, Syndicatus, Syndicator, Subsyndicus, Syndicaria (-ae), the reader is referred to Ducange, *Gloss. M. et I. L.*, vi. 928-931; and *Supplem.*, iii. 932. We shall merely mention that the French have the verb 'syndiquer,' for to judge or censure, as we formerly said 'to syndicate' in the same sense.

SYNE'SIUS (Συνέσιος), a Christian philosopher of the school of the New Platonists, was born at Cyrene, in Africa, of a high family, in the year 378 A.D. He studied at Alexandria mathematics and philosophy under Hypatia, and at the same time gave attention to poetry and eloquence. When only in his nineteenth year he was sent by his fellow-citizens at the head of an embassy to Constantinople, to present a golden crown to the emperor Arcadius, to whom he addressed a very suitable oration, which is still extant. At this period he was a heathen, but he was soon after converted to Christianity and baptized by Theophilus, bishop of Alexandria. He still however retained his fondness for the New Platonic philosophy; and partly for this reason, partly from unwillingness to be separated from his wife, he long resisted the desire of Theophilus to consecrate him to a bishopric. At last he yielded, and became bishop of Ptolemais, in the year 410. The time of his death is not known, but it was probably before 431, since in this year his brother Euoptius appeared at the council of Ephesus, as his successor in the bishopric of Ptolemais.

Synesius was one of the most remarkable men of his age, though certainly more eminent as a philosopher than as a Christian. His writings are in a pleasing style, sometimes rising to eloquence. With a peculiarly clear statement of the most abstract philosophical opinions, he mingled interesting illustrations from the early historians, fabulists, and poets.

The following are his chief works:—1. The Oration to Arcadius, mentioned above, 'On Royalty' (περὶ βασιλείας). 2. 'Dion, or on Self-discipline' (Δίων, ἢ περὶ τῆς καθ' ἑαυτὸν διαγωγῆς). 3. 'The Praise of Baldness' (φαλάκρας ἐγκώμιον), a witty imitation of Dion Chrysostom's 'Praise of Hair.' 4. 'An Egyptian Fable, or, On Forethought' (Αἰγύπτιος, ἢ περὶ προνοίας), an application of the fable of Osiris and Typhon to the then state of the Roman empire. 5. 'On Dreams' (περὶ ἐνυπνίων). 6. 'A Discourse to Paeonius concerning a Present' (πρὸς παιόνιον ὑπὲρ τοῦ δώρου λόγος). The present was an astrolabe, and the discourse recommended the study of astronomy. 7. One hundred and fifty-five letters. Some of these letters are free and interesting epistles to his friends, and others, on matters of business, contain much information of great value to the church historian. 8. 'Ten Hymns,' formed of a most singular mixture of Christian truths, poetic images, and New Platonic dreams. 9. Four epigrams in the 'Greek Anthology' are ascribed to Synesius.

A complete edition of the works of Synesius, in Greek and Latin, was published by Petau, Paris, 1612, fol., reprinted in 1631, 1633, and 1640. There are several later editions of portions of his works.

(Fabricius, *Bibl. Graec.*, viii., p. 221, old edition; ix., p. 198, Harles; Schöll, *Geschichte der Griech. Lit.*, iii., p. 365.)

There was another philosopher of the same name, of whom nothing more is known than that he was the author of a commentary on Democritus, which is printed in Fabricius, *Bibliotheca Graeca*, vol. viii., p. 233, old edition. (Schöll, iii., p. 445.)

SYNESIUS (Συνέσιος), a Greek medical writer, of whom nothing is known except that a treatise on Fever goes under his name: his date also is rather uncertain. Sprengel places him in the reign of the emperor Manuel (A.D. 1143-1180), apparently because he supposed the 'Zádu 'l-Mosáfer,' or 'Viaticum Peregrinantis,' of Abú Jafer Ahmed Ben Ibrahím Ben Abú Chalid Ibnu 'l-Jezzar, to have been written at the end of the eleventh century after Christ. As however Ibnu 'l-Jezzar died about the year (A.H. 395) A.D. 1004 (Wüstenfeld, *Gesch. der Arab. Aerzte*, Götting., 1840), Synesius, who translated his work into Greek, under the title Ἐφόδια τοῦ Ἀποδημοῦντος, may have lived much earlier than Sprengel places him; and this is the more probable if it be true that his translation was of service to Constantinus Afer, who died about A.D. 1087 (Choulant, *Handb. der Bücherk. für die Aeltere Medicin*, Leipzig, 1841), in composing his 'Viaticum Peregrinantium.' The treatise of Synesius is apparently part of his translation of Ibnu 'l-Jezzar's work, the whole of which, in seven books, is said to be still in existence in manuscript in the royal library at Paris. Reiske compared it with the original Arabic, and found it a very exact translation, with some few exceptions, as, for instance, in p. 136, where Synesius has made some additions to the Arabic text. In two passages we find the Arabic word added to his translation in Greek characters, viz. p. 76, ἐντεχε, *an-nat'ho, sweat*; and p. 120, ἐλμουθελλεθ, *al-muthelleth, a tertian fever*. Sprengel remarks (*Hist. de la Méd.*) that his theory of fever is taken entirely from Galen; and that the symptoms of a fever produced by continual grief are well described (p. 30); he approves also of his moral treatment of febrile affections (p. 58). The means of cure mentioned by Synesius are in con-

formity with the habits and natural productions of Arabia. He constantly recommends water, sugar, and oil of roses; his purgative medicines are prunes, myrobalans, and cassia; he also exhibits camphor internally (p. 240). The most curious part of the work is the description of the small-pox, which he calls φλυκταίνουσα λοιμική, and which he distinguishes from the measles, or ἑτέρα λεπτὴ καὶ πυκνὴ λοιμική. Synesius is the first Greek author who notices these two diseases; but all the details that he mentions concerning them are taken from the treatise by Rhazes on the same subject. [Rhazes.] The work was edited by J. St. Bernard, Amstel. and Ludg. Bat., 8vo., 1749, with the title, 'Synesius de Febribus, quem nunc primum ex Codice MS. Biblioth. Lugd. Batav. edidit, vertit, notisque illustravit J. St. B.; accedit Viatici, Constantino Africano Interprete, libri vii. pars.' The six first chapters are inserted in the Venice collection of writers 'De Febribus,' 1576, fol.; the two last are in the first volume of the *Opera* of Constantinus Afer, Basil., 1536, fol.

SYNETHE'RES, or SYNÆTHERES. [Porcupines, vol. xviii., p. 416.]

SYRNIUM, Savigny's name for a subgenus of owls.

Example, *Syrnium Aluco*, the well-known brown owl, tawny-owl, ivy-owl, or wood-owl of these islands. [Strigidæ.]

SYNGNATHA, according to Dr. Leach, the second order of the class *Myriapoda*, comprising the species of that class which were by Linnæus included under the head *Scolopendra*.

This order is divided by Latreille into two sections: the species of the first have only fifteen pairs of legs; and the body, when viewed from above, presents less segments than when viewed from beneath. In the second section there are at least twenty-one pairs of legs, and the segments are of the same size and number both above and beneath. Dr. Leach also divides the present order into two sections or families, to which he applies the names *Scolopendridæ* and *Geophilidæ*, which he characterises as follows:—the first (*Scolopendridæ*), by having each segment of the body provided with two legs, and the hinder legs distinctly longer than the others. To this family belongs the *Scolopendra forficata* of Linnæus, a species found commonly under stones, &c. in this country and other parts of Europe. According to the author last mentioned, this species constitutes the type of his genus *Lithobius*, distinguished by the antennæ being composed of forty or more joints, the two first of which are the largest; the under lip is broadly notched in front, and has the margin much denticulated; the eyes are granulated; the legs are fifteen on each side. The genus *Cryptops* of Leach, of which a species (*C. hortensis*) is found in gardens in Devonshire, has about seventeen joints to the antennæ; the under lip is not denticulated, and it is scarcely emarginated in front; the legs are twenty-one on each side, and the first joint of the hinder legs is spineless; the eyes are indistinct.

In the family *Geophilidæ* the legs are very numerous, and the hinder legs are not distinctly longer than the others. The species of the genus *Geophilus* (Leach) have upwards of forty legs, the antennæ have fourteen joints. Several species are found in England; they live in the ground and under stones. The *Scolopendra electrica* of Linnæus belongs to this genus.

SYNOD, a Greek word, Σύνοδος (literally, 'a coming together'), adopted by the Saxons, sometimes used for an assembly of any kind, but much more commonly for an assembly gathered for ecclesiastical purposes, and more particularly for an assembly of bishops or presbyters deputed by various churches or branches of the universal church to meet at an appointed place, there to deliberate on points of doctrine or other matters relating to the regulation and welfare of the church. These synods are also called councils.

In the history of the church we meet with many councils; but some are of far higher dignity and consequence than others. The highest are those which were held in the early centuries of the church, and have been approved and termed *œcumenical* by almost the whole body of professing Christians. Of these there have been only six. Some however of the councils of inferior authority are regarded as œcumenical by certain portions of the church.

By œcumenical is meant, representative of all the different branches of the church established throughout the habitable world (οἰκουμένη). It is not however implied thereby that bishops from all Christian sees must be present at a synod in order to constitute it œcumenical, for the whole body of bishops were never present at any council that has been hitherto held; but if the Christian world consent then or afterwards to its decree, its œcumenicity is considered as established.

The Apostolical council held at Jerusalem on the question of legal observances is regarded as a model and kind of Scripture authority for such assemblies. All the Apostles were not there, but their decisions were admitted by the body of Christians generally.

The six œcumenical councils are the following, and it is commonly understood that since the Apostolic Council these are the only councils whose decrees have been generally admitted by the church:—1, the Synod of 318 bishops at Nice in Bithynia, A.D. 325; 2, the Synod of 150 bishops at Constantinople, A.D. 381; 3, the Synod of 200 bishops at Ephesus, A.D. 451; 4, the Synod of 630 bishops at Chalcedon, A.D. 451; 5, the Synod of 165 bishops at Constantinople, A.D. 553; 6, the Synod of 170 bishops at Constantinople, A.D. 680. The Eastern church regards another Synod as œcumenical, that at Nice, under Irene, A.D. 787; and the Western (Roman Catholic) church contends that several others are entitled to be so regarded, but it is not agreed what is the number.

The Protestant churches admit of the first four only as being properly œcumenical: but they virtually include the fifth and sixth as supplementary to the third and fourth, and not condemning any new heresies.

A brief notice of each of the six great councils follows:—

(1) The Council of Nice. This was assembled by order of the emperor Constantine to determine the Arian controversy. By its decree it anathematized the doctrine of Arius. This decree was generally approved, and confirmed by subsequent councils.

(2) The first council of Constantinople. This was assembled by the emperor Theodosius the Elder, to appease the troubles of the East. It anathematized the heresy of Macedonius, who denied the divinity of the Holy Ghost. Its decree was sanctioned by the subsequent synod of Chalcedon.

(3) The Council of Ephesus was assembled by Theodosius the younger, to determine the controversy raised by Nestorius, bishop of Constantinople, who declaimed against the title Θεοτόκος, which Christians had long applied to the mother of Jesus Christ. The Nestorian doctrine was condemned by the Council of Ephesus, whose judgment was subsequently confirmed, like that of the first Constantinopolitan synod, by

(4) The Council of Chalcedon, which was assembled by the emperor Marcian. Besides ratifying the creeds of the three preceding councils, it condemned the Eutychian or Monophysite heresy, namely that which maintained that there was only one nature in Christ after the Incarnation. Some of the churches in Egypt and Palestine retained the Eutychian heresy notwithstanding.

(5) The Second Council of Constantinople was assembled by Justinian. It condemned certain writings which favoured the Nestorian opinions.

(6) The Third Council of Constantinople was assembled by the emperor Constantine Pogonatus, to terminate the divisions caused by the dogmas of the Monothelites, who held that after the union of Christ's divine and human nature, there remained in him but one will and operation. In its decree condemnatory of this error, the synod published a definition of the faith, in which they acknowledged the five preceding œcumenical councils.

Of the other more remarkable councils, the following brief tabular statement may suffice:—

Councils before the separation of the Eastern and Western Churches.

Place of Assembly.	A.D.	By whom called.	Decrees.
Sardica . .	347	Constans and Constantius	Re-established in their sees the bishops who had been dispossessed by the Arians.
Ariminum . .	360	Constantius	Altered the wording of the Nicene creed at the instigation of the Arians.

Place of Assembly.	A.D.	By whom called.	Decrees.
Ephesus .	449	Theodosius	Absolved the heretic Eutyches from censure, and deposed Flavianus, who had condemned him.
Constantinople	754	Constantine Copronymus	Condemned the use of images and pictures in churches.
Nice . .	787	Irene	Reversed the condemnation.
Constantinople	869	Basil	Deposed Photius, patriarch of Constantinople.
Constantinople	879	Basil	Restored Photius.

Councils held in the Western Church, chiefly after A.D. 1054, *when the patriarchs of Rome and Constantinople separated from communion.*

Place of Assembly.	A.D.	By whom called.	Decrees.
First Lateran	1123	Calixtus II.	Confirmed the agreement between the emperor and pope about the investiture of prelates.
Second Lateran	1139	Innocent II.	Condemned the Manichæan heresy.
Third Lateran	1179	Alexander III.	Regulated the election of the pontiffs.
Fourth Lateran	1215	Innocent III.	Published a Confession of Faith condemnatory of the Manichæan heresy.
Lyon . .	1245	Innocent IV.	Deposed the emperor Frederick.
Lyon . .	1274	Gregory X.	Defined that the Holy Ghost proceeds from the Father and the Son.
Constance .	1414	John XXIII.	Condemned the errors of Wickliffe and Huss, and approved the administration of the Eucharist in one kind only.
Basle . .	1431	Martin	Declared the superiority of a general council over the pope.
Florence .	1437	Eugenius IV.	Asserted purgatory; and that the Roman pontiff is head over the whole church.
Trent	1545 to 1563	Different popes	In reference to the Protestant heresies.

High authority is claimed by Roman Catholic writers for the last-named council, which they contend ought to be regarded as œcumenical. This is strongly controverted by Protestant writers.

Very few synods or councils have been held in the Protestant churches. By far the most remarkable is that of Dordrecht or Dort, which was assembled in the reign of our king James I. Its professed object was to compose the differences existing between the Calvinian and Arminian parties in the Protestant church. The former prevailed.

Some hold that there is a peculiar superintendence exercised over these assemblies besides that ordinary superintendence which God maintains in the affairs of men: others look upon these assemblies as being to be placed in the same category with other assemblies of fallible men, in which human infirmities and passions enter, and the judgment is ultimately affected by all the ordinary accidents to which the divisions of large assemblies of human beings are liable.

The doctrine of the Church of England respecting councils may be seen in the Twenty-first Article.

Lists, very full and perhaps complete, of the several councils which have been held, may be found in many treatises on chronology, particularly the 'Tablettes Chronologiques,' of M. Dufresnoy; and in 'L'Art de Vérifier les Dates.'

SYNODIC, SYNODIC REVOLUTION (σύνοδος, conjunction of paths). The synodic revolution of two bodies which move round a common centre is that portion of one or more actual revolutions in which they go through all their possible relative positions. The simplest instance which can be given is that of the two hands of a watch: the absolute revolution of the minute hand is made in one hour, that of the hour hand in twelve hours; but the synodic revolution of the two hands is the interval which elapses between any time at which they are together, and the next time at which the same thing takes place.

Every phenomenon which depends upon the relative position of two revolving bodies cannot complete all its phases in less than a synodic revolution. Thus, in the case of the sun and moon, the total disappearance of the latter which takes place when they are nearest in the heavens, cannot take place again until they are again at their nearest, that is, until the moon has not only completed the circuit of the heavens, but has further progressed until she overtakes the sun. The actual revolution of the moon is not an object of interest, except to those who watch her progress among the fixed stars: the phases which are visible to all the world depend solely on her motion relatively to that of the sun. Those who would make a common watch tell time in a manner resembling the indications of luni-solar phenomena must rub out the marks of minutes and hours from the dial-plate, and choose for an interval of measurement that which elapses between successive conjunctions of the minute and hour hands.

If the two revolutions be made in the same direction, and if T and t be their respective times, T being the greater, the time of the synodic revolution is

$$\frac{\mathrm{T}t}{\mathrm{T}-t}$$

For, if x be the time of a synodic revolution, the portion of an actual revolution which the quicker has gained upon the slower is

$$\frac{x}{t}-\frac{x}{\mathrm{T}};$$

but by hypothesis this is a whole revolution, since the synodic period is nothing but the time in which the quicker gains a whole revolution upon the slower. Equate the last formula to unity, and the resulting value of x is the first formula. But if the two revolutions be made in opposite directions, the synodic revolution is made in the time

$$\frac{\mathrm{T}t}{\mathrm{T}+t}$$

Thus in the case of the hands of a watch, $\mathrm{T}=12^{\mathrm{h}}$, $t=1^{\mathrm{h}}$; and $\frac{12}{11}$ of an hour, or $1^{\mathrm{h}}\ 5^{\mathrm{m}}\ \frac{5}{11}$, is the interval of two conjunctions of the two hands.

To find roughly the synodic period of the sun and moon, let us take the sun's actual revolution at 365¼ days, and the moon's at 27¼ days. We have then

$$\frac{365\frac{1}{4}\times 27\frac{1}{4}}{365\frac{1}{4}-27\frac{1}{4}}=29\tfrac{1}{2}\text{ days nearly.}$$

SYNOI'CUM, a genus of Ascidians, thus defined by M. de Blainville:—

Generic Character.—Body more or less cylindrical, vertical, or horizontal, adhering by the cephalic extremity, and united together by the sides of their external envelope, so as to constitute a common mass, which is a little diversiform and fixed; the two apertures of each composing animal hidden at the bottom of a more or less deep cavity, and having only a single external orifice, furnished ordinarily with six tentaculiform papillæ.

M. de Blainville thus divides the genus:—

A. Species united into a convex rounded mass. (*Pulmonella*, Lam.; *Aplidium*, Sav.)

Example, *Synoicum Ficus*.

B. Species in which the horizontal bodies unite together in a mammillated crust.

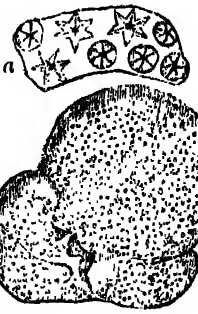
Example, *Synoicum subgelatinosum*.

C. Species in which the vertical bodies also unite together in a crust. (*Didermum*, Sav.)

Example, *Synoicum fungosum*.

D. Species in which the very long vertical bodies unite

together in a species of cylinder, having only a single external orifice common to all the individuals.



Synoicum Ficus. *a*, a portion highly magnified.

Synoicum turgens.

M. de Blainville remarks that this genus, although very closely approximated to Botryllus, is really very distinct from it, in consequence of the manner in which the apertures of each composing animal terminate in a common cavity, with a single external orifice. He adds that it contains no more species than the genera above proposed, and that they appear all to belong to our seas. (*Malacologie.*)

SYNONYME (συνώνυμος). It will appear from the following definition, by Aristotle (*Categ.*, c. i), that this word was not used by him in the same sense in which it is used now: 'Those words are Homonyma (ὁμώνυμα) in which only the name is common, but the definition (λόγος) of the substance (οὐσία) with reference to the name is different; for instance, we call "animal" both man and the painting of a man, in which cases only the name is common; but the definition of the thing with reference to the name is different; for if a man explains what is meant by each being "animal," he will give a separate definition for each: those words are synonymes (συνώνυμα) in which both the name is common, and the definition of the substance with reference to the name is the same; for instance, both man and ox are "animal;" for both are called by a common name, and the definition of the substance is the same; for if a man gives a definition of each, what is meant by each being animal, he will give the same definition.'

At present the word synonyme is applied to different words, which mean, or are supposed to mean, the same thing: as valor, courage; virtue, goodness; vice, wickedness. Though words are often considered to be synonymous, it is probable that very few words in the same language really are synonymous. If we compare two languages, we may find synonymes; thus the words for man, horse, dog, &c., taken in any number of languages, may be considered synonymous. Words belonging to the same language may also be synonymous, where the language has received additions from various other languages, among which additions there may be terms which are synonymous (in the modern sense) with native terms of the language into which they are introduced. Thus in English there may be Saxon terms which are, or rather once were, synonymous with other terms which have been introduced into the English immediately from the Latin, or through the medium of the Italian and the French. It is said 'once were,' because though such words may have been synonymous originally, and introduced by writers for the sake of variety or harmony, or to avoid repetition of the same word, it rarely happens that such words continue to have their original meaning.

SYNO'VIA, or joint-oil, is the name applied to the fluid by which the joints of the bodies of animals are lubricated. It is separated from the blood which circulates in the vessels immediately surrounding the joint. These form a very close capillary network in the tissue which bounds the cavity of the joint, and which, when it can be separated in a distinct layer, is termed the synovial membrane. [Articulation.] Synovia is a pale yellow viscous fluid, which, when rubbed between the fingers, is peculiarly slippery, without being in any degree oily. In the horse, it was found by John (whose analysis is confirmed by those of several other chemists) to consist of

Water	92·8
Albumen	6·4
Uncoagulable animal matter, with carbonate and hydro-chlorate of soda	0·6
Phosphate of lime	0·15
Traces of ammoniacal salts and of phosphate of soda	·05
	100·

Its quantity is in direct proportion to the size of the joint, and is always sufficient to keep the articular surfaces smooth and slippery, and to fill up those recesses in the joint into which the adjacent soft tissues do not exactly fit.

SYNTAX. [Language; Organon.]

SYNTAXIS. [System, Ptolemaic.]

SYNTEA. [Silhet.]

SY'NTHESIS (σὺν and θέσις, putting together). In the article Analysis we have stated the manner in which the terms synthesis and analysis are usually applied in mathematical language: the following remarks on the connexion of these terms will not be out of place in the present article.

Synthesis teaches by construction; analysis, by the undoing, as it were, the parts of a previous construction. If the construction of a watch were actually shown, and its capability to fulfil the object of the maker inferred from the consideration of the necessary connexion of the parts (not merely proved by experiment from the going), this would be a synthetical explanation. But if, the actual performance of the machine having been first contemplated, its structure were then to be examined, by pulling it gradually to pieces, and properly inferring the effect of each removal, this would be an analytical examination.

We doubt very much whether pure analysis or pure synthesis exists in large quantities in an unmixed state in any science whatsoever. The chemist, for example, may apply the terms technically, and so far properly enough, to actual physical composition and resolution: but taking his processes as acts of the mind, it will be found that his synthesis is often a result of previous analysis, and his analysis always contains synthesis. To a learner, in all sciences, everything is synthesis; he cannot make one step for himself except by experience of problems similar to the one on which he is to try his own powers.

In the exact sciences there is something like analysis, but much intermingled with synthetical processes. M. Charles (*Encyc. Méth.*, 'Synthèse') says there is hardly such a thing as analysis, properly so called, in mathematics; and, using the word analysis in the strict sense, we should agree with him, and add that, except for learners, there is as little of pure synthesis. Generalization and abstraction, the application of that which has been found effective in the species to all other cases of the genus, and the separation of that which appears at first peculiar, but on further examination turns out to be only peculiar because a mode of thought capable of wide application has been incidentally mixed up with those which *are* essential to the problem in question—are two of the most powerful instruments of mathematics. But to which do these belong, to synthesis or to analysis? If every separation of ideas be analysis, the latter process may have that name; if every farther application of that which has once succeeded be synthesis, the former may be also. But the strict use of these terms would not allow of either extension; and if we be right in saying this, it unquestionably follows that pure analysis and synthesis, far from being the only instruments of the exact sciences, are not even the most prominent ones. When Newton, having discovered the law of the binomial theorem for positive integers, proceeded to try and verify the application of that law to fractions, it would be hard to make his process either analytical or synthetical, or a compound of

both, except by such extension of the terms as would destroy their distinctive use.

Under the general notion that all inquiry which proceeds in a reverse order is analysis, and that all which may be dignified by that name is sound mathematical reasoning, much fallacy has been introduced into the elements of mathematics, the effects of which are only beginning to disappear. The process is as follows:—assume a problem to be solved; proceed to separate the known from the unknown, or in any manner to make that which is unknown capable of being compared with the known; the result when obtained is the solution of the problem: such is the language held. But it was forgotten that the assumption of the possibility of solving the problem *was an assumption;* and that the conclusion should have been, not 'This is the solution of the problem,' but 'If the problem have a solution, it must be this.' To illustrate the faulty method by an example, suppose a beginner in algebra, with a competent knowledge of arithmetic, and without any absurd pre-definition of negative quantities, has the following question proposed: 'Given $3x-11=5x-15$; required the value of x.' He is told to proceed thus:—

$$\begin{array}{lrl} & \textit{Let } 3x-11 & =5x-15 \\ \text{Add } 15-3x \text{ to both sides} & 15-11 & =5x-\ 3x \\ & \text{or} \quad 4 & =2x \\ & \text{or} \quad 2 & =x \\ \textit{Therefore} & x=2 & \text{is the value required.} \end{array}$$

Now the fact is, that the equation proposed is impossible to such a student: all that is proved is that *if* there be a solution, it is $x=2$; but when he is told to try whether $x=2$ is a solution, he finds $3\times 2-11$, an operation which cannot be performed, at the first step. Of the same nature is the assumption which was till lately part of most proofs of Taylor's theorem, namely, that $\phi(x+h)$ can always be expanded in integer powers of h: and the consequence was that most works on the differential calculus were defaced by a subsequent admission that a proposition previously declared universal was not universal; and students received a practical caution to append 'errors excepted' to every Q.E.D.

As these blots are gradually removed, so does the surface of the higher mathematics become more and more synthetical in all the elementary parts. Gradually generalization opens the road of analysis in the antient sense: when the student has step by step arrived at the power of comprehending that view of algebra which defines or interprets -1 and $\sqrt{-1}$ with rigor, he can then set out with the theorem that every equation has a solution. And in the same manner, when the complete meaning of a differential co-efficient (for every index of differentiation) is fully settled, such preliminaries may be obtainable as will enable the higher student to ground his approach to Taylor's theorem on such a form of expansion as will not afterwards 'fail.'

In the meanwhile there is a view of the higher mathematics, which will render the common term *analysis*, as applied to them, appropriate enough. The farther we proceed the greater is the power of taking out the reverse process in which analysis was defined to consist from the domain of the hypothetical syllogism, and placing it in that of rigorous deduction: the consequent increase of the power of pure analysis, or at least of that proceeding which most resembles it, may suggest the application of the term as descriptive at least of the ultimate tendency of all progress, though not of a result as yet entirely obtained.

SY'NTIPAS. This is the title of a collection of stories, written in Greek, and bearing the name of Michael Andreopulus, but the collection is evidently translated from an Oriental work. It is hardly necessary to remark that the Eastern collections of moral stories are usually so told as to grow one out of the other, in a manner of which we have an instance in the 'Arabian Nights;' but a much better example in a work not so popularly known, the English translation of the fables commonly known as those of Pilpay. It is, perhaps, not so generally known, however, that many of our best European fictions, as well single stories as whole collections, may be traced from Europe to Arabia, and from Arabia to India, and that the Indian form of the story or collection almost invariably bears the marks of an earlier origin than any other form, and appears to be, if not the original form, at least the oldest surviving one. This fact, interesting in itself, becomes doubly so when taken in connection with the philological discoveries of the latest period of etymological research; discoveries which have placed the *language* of India in much the same relation to the oldest known form of the German, as we have supposed the fictitious *literature* of India to hold to that of Europe. Many of the stories of Syntipas are found almost verbatim in an Arabic manuscript of the 'Arabian Nights,' in the British Museum, but the whole style of the stories points evidently to an Indian origin.

Syntipas is the name of a philosopher to whom is committed the education of a certain Persian prince, the son of a king Cyrus. By his judicious management he teaches the boy more in six months than he had learnt from his other masters in as many years; but at the time when the king wishes in person to prove the acquirements of his son, the preceptor discovers by his skill in astrology that a great danger hangs over his pupil, which can only be averted by the silence of the latter during seven days. The king and his courtiers are naturally 'much perplexed' by this unlooked-for event, and many ingenious guesses are wasted as to the cause; at last one of the king's women undertakes to bring her step-son to speech. After trying many blandishments, she confesses to him in plain words a passion which she has conceived for him, proposing to him to poison his father, and to take her to his arms and his throne. Horror at this treason extorts from the young man that speech which it had been prophesied was to be so dangerous, and the queen, following the example of every heroine of a similar story, accuses the prince of attempted violence. The king wishes to put his son to death, but is dissuaded by one of the instructors of the prince, who tells one of the most elegant stories in the series, on the evil of hasty judgments. A certain king, says the sage, attempted to seduce the wife of one of his attendants, but was repulsed by her virtue, and desisted from his design, leaving, however, his ring on a couch. The husband finding this token of his wife's infidelity as he imagines, separates himself from her, but assigns no reason for this till his wife's brothers complain of his conduct to the king, making their accusation under the parable of a man to whom they had let a field, and who had suffered it to lie waste. Following up the metaphor, the husband assigns as the reason of his conduct, that he has seen the foot-prints of a lion in his ground. The king acknowledging this ingenious reproof, confesses that the lion has indeed been there, but that he has in nowise injured the field, and that he will not return to it again.

The same counsellor tells the story of the parrot set by its master to watch his wife and report to him her conduct during his absence. The bird informs his master that his wife receives the visits of a lover; but on a subsequent evening the woman, by pouring water over his cage, and counterfeiting the noise of thunder, induces him to report to his master that a violent storm has hindered him from noting what has passed; and the master, knowing this story to be incorrect, imagines that the more important one previously told him was as little worthy of belief. This same tale is told with some amplification in the Tooti Nameh. The queen then tells an unimportant story of a father attempting to save his son from drowning, and being himself carried away by the current. The application she makes of this story is, that the king had need beware, lest in his compassionate willingness to spare his treacherous son, he should be himself betrayed to death. The second sage then tells a story, which is found in the Pancha Tantra,* of a woman who, while in company with her lover's page, perceives his master approaching. The page is hidden, and, whilst she is entertaining her lover, the husband comes in. Seeing him at a distance, she directs the lover to take a stick in his hand, and go away as if in anger; and she explains to her husband, that this man, their neighbour, had come to look for his page, who had taken refuge in her house, and had gone away angry, being unable to find him. In counteraction of this, the lady relates the story of the young prince betrayed by his counsellor into the hands of the Ghoule, as told in the 'Arabian Nights.' The Ghoule is a Lamia in this version, and the young man cries to Christ instead of Mohammed. The third counsellor relates how two tribes were involved in war for a vessel of honey.†

* The Pancha Tantra is the Indian original of the Fables of Pilpay. A later modification of this collection (the Hitopadesa), containing nearly the same stories, has been translated into English by Sir William Jones, and also by the late Sir Charles Wilkins.

† A somewhat similar story, but more artificially related, occurs in Dubois' (professed) translation of the Pancha Tantra. In this latter, the honey is

(There is an Arabic proverb which alludes to a similar catastrophe resulting from the breaking of an egg.) He also tells how a certain woman, going to buy rice, was offered sugar with it, gratis, on condition of certain complaisances to the vendor. While she is within the house, the shop-boy empties the sugar from the bag and fills it with dust. When this is discovered by her husband, she pretends that, having dropped the money, she gathered up the dust, hoping to discover in it what she had lost. The husband helps to sift the dust, and, so says the malicious narrator, 'defiled his own beard.' The queen hereupon relates how a prince on his way to his bride was decoyed by his father's vizier to drink of a fountain which changed him into a woman. A traveller whom he meets, hearing his miserable story, consents to exchange sexes with him, on condition of a restoration within a certain time. At the time fixed however, the transformed woman informs the prince she is pregnant, and he, pleading the injustice of taking upon himself this additional burden, refuses to complete his agreement.* The fourth philosopher then tells a story of a bath-keeper giving up his wife to a young prince, in the false hope of obtaining profit without dishonour. The same sage tells another story, of a man leaving his wife, each taking to the other an oath of perfect fidelity during their separation. Towards the end of this term, a young man seeing the wife becomes enamoured of her, and seeks to be introduced to her through the intervention of an old woman in his neighbourhood. This latter persuades the wife to grant her employer a meeting, by a story of her daughter having been turned into a black bitch for her cruelty to a lover. The old woman going out to seek her employer is unable to find him, but brings with her the first man she meets, who proves to be the absent husband. The point of the story is in the readiness with which the wife vindicates herself, and puts her husband in the position of the injuring party, by representing the whole occurrence as a trap laid to try his fidelity. The queen tells a foolish story of a wild boar, who, looking up in vain for the figs which he expected an ape to throw down to him, burst the arteries of his neck and was killed. The story of the fifth sage is that of the hound slaying the serpent in defence of his master's child, of which we have a current European version in the legend of 'Beth Gellert.' He tells also another story of an old woman who procures the expulsion of a wife from her husband's house by laying a man's cloak, known to the husband, under his couch; and afterwards contrives to restore the wife by professing to have left the cloak there by forgetfulness. The queen then tells a story of a thief coming into an inn by night to steal the travellers' mules, and finding there a lion which had come for the same purpose, and which he mistook for a mule and mounted. The lion, taking this man for the 'guardian-dæmon of the night' (ὁ δαίμων ὃν λέγουσι τῆς νυκτὸς εἶναι φύλακα), is terrified, and suffers him to keep his place quietly till the morning, when the man escapes into a tree. A monkey, meeting the lion, asks the cause of his terror, and assuring him that the supposed dæmon is a man, persuades him to return to the tree to kill him. The lion consents; but the thief contriving to kill the monkey in the tree, the lion, still more terrified than before, takes a precipitate flight.†

The two doves is a story told by the same sage, as a warning against hasty judgments. They had gathered a provision of corn for the winter, which being wet shrank in drying. The male dove, seeing this, accused his mate of having clandestinely robbed the store, and on her denial of this charge killed her. When the rains came, and the grain swelled to its original size, he discovered his error, and too late repented of it. This is one of the fables of the Kalilah wa Dimna, or Arabic version of the Pancha Tantra, but is not found in the Hitopodesa, the later Indian version. The story of the woman into whose basket had been introduced a honey-cake elephant is much of the same stamp as that of the woman buying rice (already quoted), but is hardly decent enough for quotation. The same judgment may be passed on the man with three wishes,—a satire on the vanity of human desires which has been repeated in a hundred different forms. The next story is also one of those malicious yet favourite jests of which every nation has a copy. A certain scholar has occupied himself, like the husband of the Wife of Bath, in collecting the wiles of women; of the folly of which attempt the wife of his host convinces him by a story and a practical exemplification.

At this point the prince, whose days of trial are accomplished, breaks silence, and explains the perfidy of his step-mother. This, though the end of his danger, is not the end of the story. A question arises, who of all the parties concerned would have been in fault if the prince had been put to death. The blame is successively cast upon every one of the actors in the story, when the prince, premising that his knowledge, compared with that of the sage, is 'but as a fly to an elephant,' begs permission to relate an apologue. A certain man made a feast, where amongst other viands there was milk for the guests' drinking. Now as the maid-servant had brought this from the market on her head, a bird with a serpent in its claws had flown over it, and the serpent in its agony disgorged its poison into the vessel. The guests all drank and died, and the question is raised, who was blameable? The prince gives it as his opinion that blame rests upon no one agent concerned, but that the death of the guests was the result of destiny, and applies the same judgment to the hypothetical case of his own condemnation and execution. There are then told three stories: two of the wit of children, and one of the simplicity of an old man. The first of these is of a child who by his extravagant and petulant hunger laid a train for removing his mother's lover; the second the well-known story of the three men who put their money into the hands of a woman, charging her to return it to the three only. One of these contrives to obtain possession of the money by fraud; and when the other two claim from her their deposit, by the advice of a child she holds them to the words of their bargain, that she was not to deliver up the money except to *three*: she cannot therefore give it, till the third, the thief, shall appear. The third story is of a merchant selling aromatic woods, who unhappily enters a certain city where the inhabitants all pique themselves upon their knavery. One of these, lighting a fire of aromatic woods, persuades the merchant that they are in that city so cheap as to be commonly used for fuel, and induces him to part with his whole stock at a low rate, for a small coffer full—he does not say of what. A little after this notable bargain, our merchant chances upon a company of these knaves (μῖμοι, the Greek author calls them), and is challenged by one of them to a trial of wit, the loser to be subject to the command of the elder. The merchant is beaten, as may be supposed, and is enjoined by the victor to drink up the waters of the sea—an old quibble. Putting off the execution of this arduous duty till the morrow, he is assailed by another 'mime,' a one-eyed worthy, who insists that the merchant, grey-eyed like himself, has stolen his missing optic, and drags him before the judge. On his way he is met by his hostess, who engages for his re-appearance and takes him home. After a feminine lecture to him for slighting her advice, for she had warned him of the character of her fellow-townsmen, she informs him that an old man holds a sort of school of knavery, whither the townspeople resort to receive his judgment upon their day's proceedings; and she advises him to be present there in disguise. Acting upon this suggestion, he hears his three friends severally recount their adventures, and the archmime blames each of them in turn: the first, because he might be required by the merchant to fill the stipulated measure with fleas, half male and half female, part blue-eyed and part dark; the second, because the merchant might if he pleased refuse to drink up the sea unless the rivers are kept from flowing into it; and the third, because he has left himself open to an embarrassing

brought to the king by a huntsman, and a drop falling on the ground, a fly settles on it; a lizard seizes the fly; the king's favourite ichneumon attacks the lizard; the hunter's dog fastens on the ichneumon; the king strikes the dog; the huntsman, grumbling at the animal's punishment, is beaten by the king's order, and a general mutiny of all the huntsmen of the district is the consequence. We have many *chain-stories* of this kind in our own language, scarcely perhaps grave enough for type, but which any one, whose memory can reach to his nursery years, will readily remember.

* A story of the same kind, but with greater marks of originality, is found in Dubois' translation of the 'Pancha Tantra.'

† This is but an indifferent story in the hands of the Greek author, but 'it was a good jest when he heard it.' It is evidently derived from the following, which occurs in Dubois' version of the 'Pancha Tantra.' An old goat by mistake enters the den of a lion, and seeing flight to be useless, walks boldly up to him. The lion, somewhat dashed at the grave assurance of this strange figure, inquires the meaning of his visit, and is told that the bearded monster has vowed to slay so many tigers, and so many lions, and that having finished the first part of his task, he is ready to begin the second. The lion makes the best of his way out of the den, but the fox meeting him, laughs at his terrors, explains the real nature of the supposed monster, and persuades him to return. The goat, on the approach of the two, cries out to the fox, 'I bade thee bring me *two* lions, why hast thou brought only one?' and the lion, naturally concluding that the fox has betrayed him, escapes in greater terror than before. In the 'Tooti Nameh' a similar story is told of a lynx, or Siyah Gosh, and a lion; and Keightley, in his 'History of Fiction,' tells the tale in another form, of a man who, by a similar artifice, was delivered from a Ghoule,

demand from the merchant, in case the latter should think of requiring that the eyes of each party should be taken out and weighed, to determine the ownership of the disputed one. Acting upon these hints, the merchant obtains the full value for his merchandize, and makes besides his own terms with his tormentors.

The punishment of the queen is then debated on, one proposing that her hands and feet should be cut off, another that her tongue be cut out, another that her heart be torn from her body. The unhappy woman pleads for herself by the story of a fox which was shut up by accident in a walled city, and, finding no egress, lay counterfeiting death at the closed gate of the city. One passer by dilates on the great virtues of a fox's tail for 'sponging mules;' another lauds the virtue of its ears for stopping the crying of a fretful child; a third declares that the teeth of a fox are 'the sovran'st thing on earth' for a fit of the tooth-ache; and each appropriates to himself the particular part he has eulogised. All this, says our heroine, the fox bore manfully; but when a fourth sage declared that a fox's heart was a remedy for all evils, and took out his knife to possess himself of this panacea, the patient took heart of grace; and leaping up, escaped safely by the gate, which had by this time been opened. The queen's moral from all this is, that she would bear patiently either of the proposed minor punishments; but that the tearing out of her heart was a 'death of all deaths most bitter.' Her step-son pleads for mercy, on the ground of the weakness of the sex; and her punishment is commuted to shaving her head, branding her on the forehead, and parading her on an ass's back out of the city. A story to show the uselessness of resisting the decrees of Providence, like a thousand and one stories of the same kind, some of which our readers will remember as given in the 'Arabian Nights,' is the last in the book, and this is closed by a description of the prince's education, and of his examination by his father.

A curious story of this kind occurs in the Pancha Tantra:—Pushpaka, the favourite parrot of Indra, is decreed by fate to die: the solicitations of all the inhabitants of the heaven of Indra are answered evasively by Yama, and Death, personified, destroys his prey during the discussion. This doctrine of the iron force of destiny is by no means so prominent an article in the Hindu code of faith as it is in the Mohammedan; and in no system, Pagan or Mohammedan, does it appear with such awful emphasis as in the Teutonic or Scandinavian mythology. The whole of this takes a tone of mysterious melancholy, from the frequent mention of misfortunes to which even the gods are subject; which they can foresee, but not avert; and from the perpetual foreboding of that destruction of all things mighty, that twilight of the gods, of which perhaps the idea may have been derived from the *pralaya* of the Hindu cosmogony; but of which the outline has been filled up by the masculine imagination of the North with details which are read with trembling. Those who are desirous of pursuing this subject farther, and of examining more minutely the connection between the fictions of Oriental and Western nations, will find it worth while to refer to some or all of the works mentioned below.* Independent of the interest which these collections possess as illustrating the connection of the two most civilised quarters of the globe, they have in themselves a high value, as illustrative of the moral features of Eastern character, of which they contain a very faithful picture. The strong bent towards a bitter humour; the preference, in all maxims of state and policy, of a shrewd and crafty to a bold course of conduct; the inveterate habit of submission to authority in matters of opinion, a disposition common enough perhaps over all the world, but preternaturally developed in Asia; and the low estimation in which the female character is held; all these points stand out so plainly in every Eastern collection of stories, that he who runs may read. The last peculiarity especially is so exaggerated a trait of Asiatic character, that the object of many entire collections of tales is to illustrate the supposed worthlessness of the female character. We are too apt to repeat the assertion that the estimation in which the women are held is an index of the degree of civilization of a nation; yet we find the degrading opinions we have alluded to prevailing through the most polished periods of Hindu and Mohammedan history: we believe indeed that history will pretty well bear out the assertion that the Gothic race alone, with the exception of the Romans, civilized or uncivilized, has held more just and manly opinions.

The Greek text of Syntipas was edited from two Paris MSS. by Boissonade: 'Συντίπας. De Syntipa et Cyri filio Andreopuli narratio, Paris, 1828, 8vo.' A translation of Syntipas into modern Greek appeared at Venice in 1805. Another work attributed to Syntipas was also translated into Greek from the Syriac by Andreopulus. It is a collection of sixty-two fables, entitled Παραδειγματικοὶ λόγοι, and was edited by Matthiæ, Leipzig, 1781, 8vo.

* 'The Heetopades' of Vishnu Sarma, translated by Charles Wilkins, 8vo. Bath, 1787.

'Kalilah and Dimnah, or the Fables of Pilpay,' translated by Wyndham Knatchbull, 8vo, Oxford, 1819.

'Contes et Fables Indiennes traduites d'Ali Tchelebi Ben Saleh,' 3 tomes, Paris, 1778

'Analytical account of the Pancha Tantra,' by H. H. Wilson; 'Transactions of the Royal Asiatic Society,' vol. i, pt i., pp. 155, et seqq.

SYPHAX. [Numidia.]

SYRA, or SYROS (Σύρα or Σύρος), at present called Siro, is an island of the Ægean, which belongs to the group antiently called the Cyclades. It is south of Gyarus, and between Ceos and Tenos. Homer (*Od.*, xv. 402), who calls the island Syrie, places it above Ortygia, and says that it contained two towns: one of them was the birthplace of the philosopher Pherecydes. Its circumference, according to some of the antient authorities, was 20,000 paces; and, according to Mucianus, 160,000 paces. (Plin., *Hist. Nat.*, iv. 22.) Homer and other Greek poets describe the island as rich in pastures, wine, and corn. (Compare Strabo, x., p. 485; Pomp. Mela, ii. 7.) There are still ruins of one of the antient towns, and many valuable relics of antiquity have been discovered in this small island.

Syra is intersected by hills and narrow valleys. The inhabitants, who previous to the year 1821 amounted to about 1000, are of the Roman Catholic religion. In the war with the Turks, Syra remained neutral, for which reason many persons took refuge there, for the purpose of carrying on their mercantile business. The population thus soon rose to 5000; and, after 1828, it amounted to 10,000. During the Greek war, Syra was the central point of the commerce of Greece. After the pacification, commerce was restored in the other parts of Greece, and, in consequence, decreased in Syra; but the chief place of the island, Asprana, is still an important position, on account of the port of Fornigi. Syra is one of the principal stations for the French steam-boats which sail from Marseille to Constantinople.

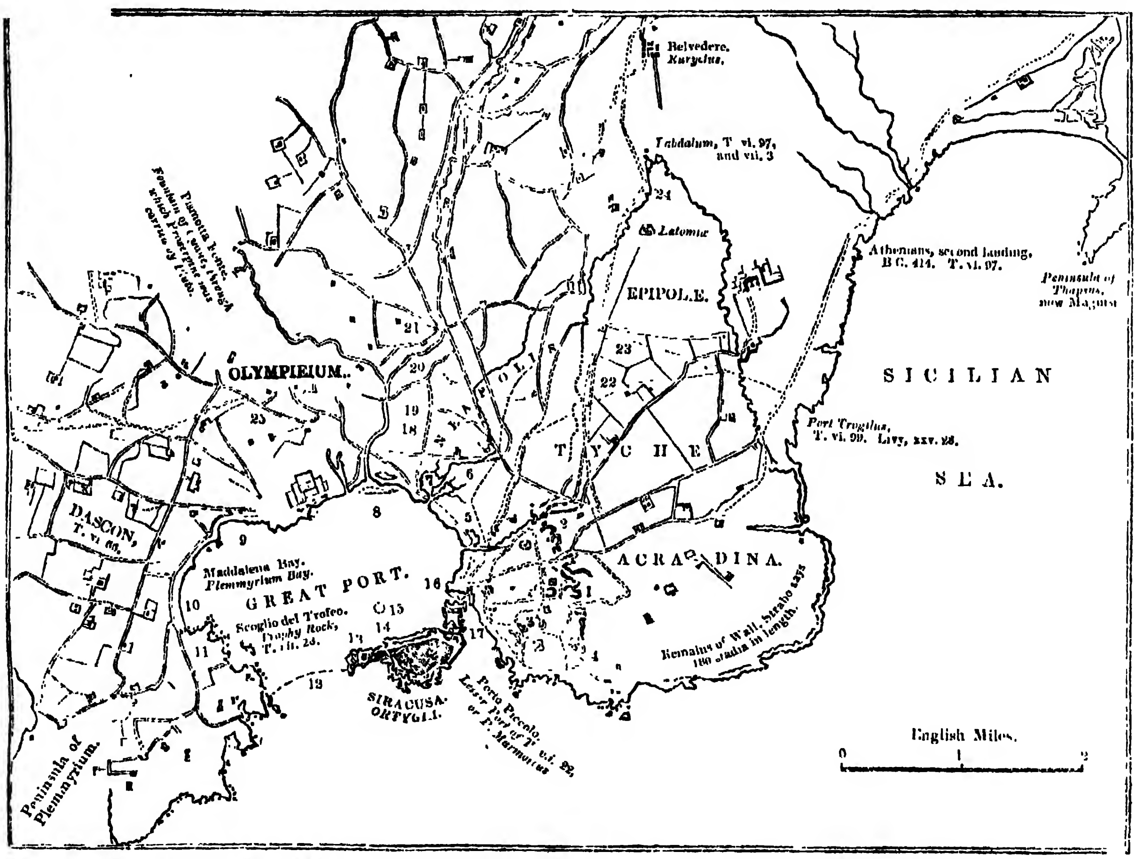
(Prokesch von Osten, *Erinnerungen*, vol. i., p. 57, &c).

SYRACUSE (Συρακοῦσαι, in Greek; *Syracusæ*, in Latin; *Siracusa*, in Italian), a town on the east coast of Sicily, 30 miles south-south-east of Catania, and about the same distance north by east of Cape Passaro, the southern extremity of Sicily. Antient Syracuse, in the time of its splendour, was the largest city in Sicily, and one of the largest in the antient world: it was of a triangular form, and consisted of five towns, adjoining one another, but separated by walls: the oldest of these towns was Ortygia on the peninsula, originally an island of an oblong shape, about two miles in circumference, lying between the Great Harbour on the west, which is a splendid piece of water about five miles in circumference, and the Little Harbour, which was paved with marble flags, on the east. On the other side of the Little Harbour was the town of Acradina, which extended for about three miles to the eastward along the sea-coast, until it reached a bay, where was the port Trogilus, outside of the city. The western part of Acradina, adjoining Ortygia, stood on low ground, on a level with the island; but the remaining and larger portion of it lay on a range of heights which stretch from the sea for several miles inland, and are divided from the lowland by a natural wall of rocks. North of Acradina, and inland, stood the town of Tyche, on the same range of heights as the upper part of Acradina, being divided from the latter only by a double wall and a via intermuralis between. Tyche extended inland to the northward for a length of above two miles, and at its western extremity was the Epipolæ, consisting of several commanding heights, which were enclosed and made into a vast fortress by Dionysius the elder. South-west of Tyche, in the lower ground at the foot of the heights, was Neapolis, or the New Town, which, at its southern end, adjoined the lower part of Acradina. The whole was surrounded by an external wall, the length of which was 180 stadia, or rather more than 22 miles. Ortygia was the first part inhabited; but the population increasing, the island was joined to the mainland by a causeway across the narrow channel of the sea, and the neighbouring low grounds were built upon. The tide of

population still continuing to flow, the heights were occupied next, and Acradina became a large and handsome town. Tyche was occupied next, and lastly Neapolis. Suburbs and gardens extended south of Neapolis to the mouth of the river Anapus, and beyond it, round the western shore of the Great Harbour to the steep peninsula of Plemmyrium, which faced Ortygia. After the Roman conquest, the population, having gradually decreased, became restricted to the original Ortygia and the lower part of Acradina, and all the upper city was already abandoned in the time of Augustus. The Saracens in the ninth century plundered and devastated Syracuse, which contained till then about 100,000 inhabitants; and from that time Ortygia, or the island, has been the only part inhabited.

The greater part of the upper town of Acradina, especially near the sea, is now a naked dreary rock, the surface having been thoroughly cleared of the materials of the antient city. No traces of antiquity, except some steps and a few courses of stones, not a vestige of a house, temple, or monument is to be seen on the extensive plain. The sea has undermined the shore, and the town-walls have fallen in and disappeared. Considerable remains of the external wall, built by Dionysius the elder, are seen farther north round Tyche and the Epipolæ, beginning from Scala Græca near the port Trogilus, and following without interruption the sinuosities of the hill. Not far from Scala Græca, at a place called Targetta, are the remains of a gate, from whence a street can be traced across the site of Tyche to the antient theatre at the other end near Neapolis. The ruts of wheels are seen deeply worn in the rock, and holes in the middle where the horses that drew the vehicles placed their feet. Traces of other streets are also seen, with foundations for walls cut in the rocks. The fields within and near the external walls of this part of the town are covered with immense heaps of stones thrown confusedly together. On the outside of the walls a green slope reaches from the foot of the rock to the plain, and is covered with old olive-trees.

Between the upper and the lower part of the town, and near the borders of Tyche, Acradina, and Neapolis, is the antient theatre, hewn out of the live rock. The steps are half hidden with bushes, poplars wave their heads over the ruins, and the water of the aqueduct rolls and falls from rock to rock, and is next collected into a small stream that flows into the Great Harbour. No part of the proscenium remains—no superstructure of any sort. When the theatre was in its perfect state, the approach to the upper seats was on a level with Tyche. Acradina lay even with the middle part, and the people of Ortygia and Neapolis had to ascend to it.



1 Antient Latomiæ or Quarries and used as prisons.
2 Ear of Dionysius, 64 feet.
3 Convent di S. Lucia
4 Convento dei Cappuccini.
5 Stockade of Syracusans, T. vi. 101.
6 Battle, T. vi. 101.; Lamachus slain.
7 Lake and Marsh of Lysimeleia. T. vii. 53.
8 Great naval battle, T. vii, 52; Athenians 86, Syracusans 76 vessels.
9 Athenians first land, B.C. 415, T. vi. 65.
10 Triremes careening, T. vii. 24.
11 Athenian camp of Plemmyrium. Three forts and stores for the fleets, T. vii. 4, 23.
12 Barrier of Triremes, T. vii. 59, and last sea fight, T. vii. 71.
13 Castello di Maniace.
14 Fountain of Arethusa, Strabo vi. 270.
15 L'Occhio della Zilica, a copious spring of fresh water through the sea.
16 Battle of the Syracusan piles, T. vii 25.
17 Forty-five Triremes, T. vii. 22.
18 Last camp of the Athenians after losing the Ep
19 Review of the Syracusan forces, T. vi. 96.
20 River Anapus—Fiume Alfeo, or Bufalaro.
21 Athenians ford the Anapus in the retreat. T. vii
22 Counter walls of the Syracusans, T. vi. 99.
23 Circular walls of the Athenians, T. vi. 98.
24 Hexapylum? Livy, xxv. 24.
25 *Helorine Road*, T. vi. 66, 70.

From the Plan of Syracuse published by the Society for the Diffusion of Useful Knowledge. T = Thucydides.

Not far from the theatre are the remains of an amphitheatre of the Roman period; and nearer to Ortygia are the remains of the palace of the sixty beds, said to have been built by Agathocles, the arches of which are constructed of a kind of hollow tubes of baked clay, and shaped like a long-necked bottle without a bottom. They are filled with mortar; and by inserting the neck of one into the wide end of the other a curved row is formed, and the whole covered with cement, on which flat bricks are laid. Near it are vestiges of the wide street mentioned by Cicero, which may be traced from the isthmus of Ortygia, and across the site of the upper town, to a spot called Santa Bonaccia, on the edge of the Portus Trogilus.

The Latomiæ were originally quarries excavated in the rocks that divide the upper from the lower town, from whence the stone for the construction of the city was drawn. They are from 60 to 80 feet deep. Some of them afterwards served as prisons; and on the surrender of Nicias the whole of the Athenian prisoners were confined in them and mostly died. The largest of these Latomiæ is annexed to the Capuchin convent of Palombino. A romantic garden and grove of fruit-trees called La Selva is formed at the bottom of it, and is secured from every wind by the surrounding cliffs. Another Latomia, which is near the antient theatre, is planted with olives, oranges, lemons, pomegranates, almonds, and figs. On one side of it, cut in

the rock, is the remarkable excavation called the Ear of Dionysius. 'It is in the shape of a parabolic curve, ending in an elliptical arch, with sides parallel to its axis, perfectly smooth, and covered with a slight stalactitic incrustation that renders its repercussions amazingly sonorous. Although a considerable portion of it has been filled up, which I ascertained by excavation, it is still 64 feet high, from 17 to 35 in breadth, and 187 deep. It has an awful and gloomy appearance, which, with its singular shape, perhaps gave rise to the popular and amusing paradox that Dionysius had it constructed for the confinement of those whom he deemed inimical to his authority, and that from the little apartment above he could overhear all the conversation among the captives.....He could not however have listened with satisfaction or advantage, for if two or more people are speaking together it occasions only a confused clamour.' (Captain Smyth's *Memoir descriptive of Sicily*.)

The catacombs are vast excavations, of very remote antiquity, for the purpose of burying the dead: they form subterraneous streets of tombs cut out of the solid rock. They were converted by the early Christians into places of refuge from persecution. The entrance to them is under the small church of San Giovanni, in the lower part of Acradina. This church is one of the oldest Christian churches in Europe. The catacombs were filled with tombs of the dead of all ages and faiths—Greek, Roman, Christian, and Saracen.

The aqueduct was begun by Gelon and enlarged by Hieron. The stream is brought in subterraneous channels from Monte Crimiti, outside of the Epipolæ, until it enters the walls at the place where the fort of Labdalum stood. It then appears above ground, being received into an aqueduct upon arches and conveyed to some mills, after which the water falls down the steps of the great theatre at Neapolis.

Outside of the walls, and on the left bank of the Anapus, near the Great Harbour, are parts of the shafts of two fluted columns of the temple of Jupiter Olympicus, which was enriched by Gelon with the spoils of the Carthaginians. They are six feet and a half in diameter, and rest upon a plinth of two steps. There are other antient remains scattered here and there, but of no ascertained character.

The modern town of Siracusa, which, since the devastation of the Saracens in the ninth century, has been confined to the peninsula of Ortygia, is fortified, and has a regular garrison, but is commanded by the height of Acradina. It is a bishop's see; has 13,000 inhabitants, narrow streets, numerous churches and convents, and other public buildings, the most remarkable of which is the cathedral, once the identical temple of Minerva, which was plundered of its ornaments by Verres. Its exterior dimensions are 185 feet in length and 75 in width. It has been repeatedly repaired, and a new façade erected in very bad taste. There are also some remains of Diana's temple near St. Paul's church.

A bath, with a spiral staircase about 40 feet deep, is seen in the church of St. Philip; and there are also vestiges of the baths of Daphne, in which the emperor Constans was murdered in 668.

The celebrated fountain of Arethusa is a large pool of water, supplied by a spring, and separated from the sea by a wall, in the Ortygia, near the Great Harbour; and about 80 yards from it rises from the bottom of the harbour a copious spring, called l'Occhio della Zilica, which, according to the antient poets, was the Alpheus of Elis.

•There is a museum at Siracusa containing the statues of the Landolina Venus and Æsculapius, some sarcophagi, a handsome collection of vases, inscriptions, coins, &c., and a public library. The principal private cabinets are those of Landolina and Capodicci.

Syracuse enjoys a delightful climate in winter, but the alluvial plain on the west side of the harbour, through which flows the Anapus, exhales pestilential miasmata in the summer months. The country around is very fertile. On the left bank of the Anapus is the fountain of Cyano, now called the Pisma: it is a circular basin of the purest water, about 60 or 70 feet in diameter, and 26 feet deep, stocked with fine fish. From it the water flows in a quiet deep stream to the river Anapus: on the sides of the stream is found the Cyperus Papyrus floating in abundance.

Many of the women of Syracuse, especially of the lower orders, are remarkable for the Grecian contour of their features. The people carry on some little trade by sea, but the place is by no means thriving.

(Bonanni, *L'Antica Siracusa illustrata*; Mirabella, *Pianta di Siracusa*; Swinburne, *Travels in the Two Sicilies*; Captain Smyth, *Memoir descriptive of Sicily*.)

History of Syracuse.—About 735 B.C., one year after the foundation of Naxos, by a colony of Chalcidians, Archias, a Corinthian, the head of a colony of Corinthians and Dorians, settled in the island of Ortygia, having overpowered the native Siculi. This settlement, which afterwards extended to the mainland, was the origin of the great city of Syracuse, a name said to be derived from a neighbouring marsh called Syraco. The epochs of the foundation of the four suburbs on the mainland, which became gradually so many large towns, are not known. Syracuse also sent colonies to other parts of Sicily, which founded Acræ, Casmena, and Camarina. The first two centuries of the internal history of Syracuse are very obscure. The government at first was in the hands of the 'geomori,' or 'gamori,' the original colonists who had taken possession of the land. Their estates were cultivated by slaves or serfs, called kyllyrii or killikyrii, who were the native Siculi reduced to bondage at the conquest. Fresh colonists coming in from other places formed the Demus, which was excluded from the body politic. The Demus however, having increased in numbers and wealth, claimed to participate in the offices and honours of the state; but about 492 B.C., the demus being joined by the kyllyrii, effected a revolution and expelled the geomori or aristocracy. The democratic government that followed was one of confusion, and did not last long, for Gelon, tyrant of Gela (τύραννος), having taken the part of the exiled geomori, marched to Syracuse with an army, and the people willingly opened the gates to him, when he was acknowledged as tyrannos, or sovereign, of Syracuse, 485 B.C. The rule of Gelon was temperate, and his reign was prosperous for Syracuse. He enlarged and embellished the town, and introduced several thousand additional inhabitants from Camarina and other towns, which he conquered. His successful war against the Carthaginians, and other particulars of his reign, are given under GELON.

After having made peace with Carthage, Gelon convoked a general assembly of the citizens of Syracuse, in which he appeared without arms or escort; and after giving an account of his public life, he offered to abdicate if they were dissatisfied with him. In reply he was saluted by the people as their saviour, and a statue was erected in commemoration of this occurrence. After his death Gelon was succeeded, according to his wish, by his brother Hieron, whose reign was upon the whole successful, but his administration was tainted with suspicion and tyranny. [HIERON I.]

Hieron was succeeded by his brother Thrasybulus, B.C. 467. Thrasybulus however proved even more tyrannical than his brother, and was driven away by the people after one year's reign. An assembly was then convened, in which a new constitution was framed. The public offices were to be filled chiefly by the antient citizens, while those who had been admitted by Gelon from other towns, as well as the naturalized mercenaries, were not to have the full right of citizenship. This occasioned a fresh revolt; the insurgents took possession of Acradina, but were defeated, and obliged to submit or emigrate. This was followed by various attempts of the wealthy citizens, who, having ingratiated themselves with the discontented, especially of the lower orders, aspired to usurp the supreme power. Several of them were executed; and in order to prevent a recurrence of such attempts, an institution was established, 454 B.C., called Petalism, in imitation of the Ostracism of Athens. Every citizen wrote upon a leaf the name of the citizen whom he thought most likely by his influence and wealth to aspire to the sovereignty; and the person whose name was written on the greatest numbers of leaves was exiled for five years. In consequence of this the more distinguished citizens withdrew themselves from public life, and the government fell into the hands of the poor. At last the citizens abrogated the Petalism.

About this time, in the period that immediately preceded the Athenian expedition to Sicily, Syracuse extended its conquests into the interior of Sicily. A native prince of the Siculi, called Ducetius, was defeated by the Syracusans, and obliged to beg for mercy, and was sent in exile to Corinth. Trinacria, the principal town of the Siculi, was taken after a most heroic defence, and was destroyed by the Syracusans and other Greeks.

In the year 427 B.C. the people of Leontini, being hard-pressed by the Syracusans, who wanted to subject them,

applied to Athens for assistance. An Athenian fleet, with troops, was sent to Sicily, but after several desultory actions peace was made between Syracuse and Leontini, and the Athenian expedition withdrew. In 416 B.C. a quarrel between the towns of Egesta and Selinus brought in the Syracusans, who took the part of Selinus. The Egestans sent messengers to Athens, who were joined by others from Leontini, and represented to the Athenians that the Syracusans threatened to become the masters of Sicily, after which they would naturally assist the Peloponnesians, with whom they had a common origin, against Athens. War was decided on at Athens, and a formidable armament sailed for Sicily, B.C. 415.

The Athenian expedition of 136 triremes, with a considerable land force, under Nicias, Alcibiades, and Lamachus, after putting into Rhegium, sailed round to Messana Camarina, Egesta, and other towns of Sicily, in quest of auxiliaries against Syracuse, but almost all the towns which did not openly join Syracuse professed neutrality. The Athenians however took possession by surprise of Catana, where they passed the winter. Meantime Alcibiades had been recalled to answer some charges, and the supreme command remained with Nicias. [ALCIBIADES.] The Syracusans sent envoys to Corinth to request assistance, and both Corinth and Sparta, the latter chiefly at the suggestion of Alcibiades, who had taken refuge there from proscription, resolved to send succour to Syracuse under Gylippus, a celebrated Lacedemonian captain.

In the spring of 414 B.C. Nicias, having embarked his troops at Catana, landed a party of them in the bay of Thapsus, north of Syracuse, which, without being perceived, ascended the heights of the Epipolæ, took possession of them, and built there a fort which they called Labdalum. They then began to build a wall from Port Trogilus to the Great Harbour, so as to enclose Syracuse on the land side, whilst their fleet blockaded it by sea. In executing this work Lamachus was killed in a fight against a party of Syracusans. In the mean time Gylippus arrived in Sicily, collected some troops from Gela, Selinus, and other towns allied to Syracuse, marched towards Epipolæ, seized the fort Labdalum, and annoyed the Athenians in their encampment. The Syracusans attacked the Athenian fleet at the entrance of the Great Harbour; the fight was not decisive; but Gylippus with his land forces surprised the forts which the Athenians had raised on the peninsula of Plemmyrium. Another sea-fight took place, in which the Athenian galleys were worsted. Soon after Demosthenes and Eurymedon arrived from Athens with a new fleet of 73 galleys and about 8000 soldiers. Demosthenes attacked the heights of Epipolæ by night, but was repulsed with great loss. Gylippus went round to the Sicilian towns to collect fresh forces against the Athenians. After several discordant councils among the Athenian generals, who saw their land troops dwindle away both by sickness and by the hand of the enemy, who was superior to them in cavalry, it was resolved to embark the soldiers secretly and sail away with the fleet. Nicias, who had never been sanguine about the success of the expedition, now opposed the raising of the siege, from a feeling of honour as well as from fear of responsibility; but at last gave way to the opinion of his brother commanders. An eclipse of the moon however frightened the army, and the departure was deferred. Meantime the Syracusans, having heard of the intention of the Athenians, made demonstrations against their camp, and at the same time attacked the Athenian fleet in the Great Harbour, and defeated it. Eurymedon was killed, and eighteen Athenian galleys were taken. The Syracusans then blocked up the entrance of the Great Harbour by means of galleys and other vessels lying at anchor, and connected by means of chains, and thus shut up the Athenians. Nicias then resolved to fight his way out with the fleet. The Athenian vessels were heavy, those of the Syracusans light: the former, in trying to break through the chain, got crowded in one mass and became unmanageable; the crews were exposed to showers of stones from the enemy, and at last the Athenian fleet was driven against the shore, and the greater part of it was taken or sunk. There remained sixty vessels, with which Demosthenes proposed to escape whilst the Syracusans in their rejoicing were off their guard, but the sailors were too discouraged, and refused to sail. At last the Athenians resolved to abandon their remaining vessels and stores, their sick and wounded, and retire by land to Catana. The army broke up on the third day after the sea-fight, in two bodies, with the baggage in the centre. After crossing the Anapus, they were much harassed in the plain by the Syracusan cavalry and light troops, and after short marches and continual fighting for several days, the corps of Demosthenes, which was in the rear, was surrounded and overpowered; part of the Sicilian auxiliaries who served with the Athenians were allowed to return to their homes, and the rest of the soldiers, about 6000, surrendered at discretion, and were taken prisoners with Demosthenes to Syracuse. Nicias arrived that very evening on the banks of the Erineus, and, crossing the river, encamped on a mountain. The next day he was informed of the surrender of Demosthenes, and was himself attacked. After fighting all that day, his men having neither provisions nor water, he moved on next morning and reached the river Asinarus, where, the men rushing to the water to drink, the Syracusans fell upon them and slaughtered them without resistance. After a great massacre, Nicias, seeing no chance of safety, implored Gylippus to stop the slaughter, and the order being given to that effect, the survivors were taken prisoners to Syracuse. Of 40,000 men who had been engaged in the expedition, all were killed or taken prisoners, and not one of 200 vessels returned to Athens.

Of the prisoners, all the free-born Athenians and the Sicilians who were with them were confined in the quarries; the rest, servants, followers of the camp, &c., were sold as slaves. Nicias and Demosthenes were put to a cruel death. The prisoners in the quarries receiving but a small pittance of barley bread and water, and having no shelter by day or night, diseases broke out among them. The bodies of the dead were left to putrefy among the living, and this created contagion, of which most of them perished. Thus ended this formidable expedition, the ill success of which broke down the power of Athens, and had a great influence on the result of the Peloponnesian war.

After the defeat of the Athenians Diocles proposed in the assembly of the citizens, that as all orders had shared in the common danger and defence, all should share alike the offices of the state, and moreover that public offices should be filled, not by election, but by lot, a measure which was adopted. Diocles at the same time compiled a criminal code of a very severe kind. This democratic condition lasted very few years, for in 406 B.C. Dionysius, a clever demagogue, was elected commander, and soon became tyrant of Syracuse. The events of his long reign, including his wars against Carthage, are narrated under DIONYSIUS THE ELDER. He was succeeded by his son, who was finally expelled by Timoleon from Corinth. [DIONYSIUS THE YOUNGER.] Timoleon established a government of mixed democracy and aristocracy. After Timoleon's death, B.C. 337, there was a period of twenty years, marked by no very important events, till B.C. 317, when Agathocles by violence and treachery usurped the supreme power in Syracuse. The extraordinary career of this tyrant is given under AGATHOCLES.

After the death of Agathocles, B.C. 289, Syracuse recovered its independence, but being distracted by factions, the people chose, in 275, for their prætor, Hieron, who was a descendant of king Gelon, and after five years more he was made king. His very long, and upon the whole happy, reign is narrated under HIERON II. He died B.C. 216. His son, HIERONYMUS, did not inherit his abilities; he rashly quarrelled with Rome, which had become the preponderating power in Sicily, and although he was murdered shortly after, his false policy was persevered in, and a Roman army, under Marcellus, laid siege to Syracuse, and took it in 212 B.C. Here ends the history of Syracuse as a state. From that time it was merely a town of the Roman province of Sicily.

(Thucydides, vi. vii.; Diodorus, xiii., xiv., xvi., xix.; Müller's *History of the Doric Race*; Burigny, *Histoire de Sicile*; Clinton, *Fasti Hellenici*.)

SY'RIA, is the present European name of a country in Asia, which is situated along the eastern shores of the Mediterranean, and is a province of the Turkish empire. The name of Syria is not now known to the Asiatics, though some of their historians call it Souristan, or Soristan, which means the country of Souria, or Syria. The name Syria (Συρία) occurs in the Greek writers, whence it passed into the Latin language. The name by which it is at present known to the Asiatics is that of Belad el Sham, or 'the country to the left.' The Mohammedans of Mecca direct their

face to the rising sun when they pray, and then Syria is to their left, and Belad el Yemen, or Yamen (the country to the right), is on the other hand.

Syria extends from 29° 45′ to 37° 25′ N. lat., and between 34° 10′ and 38° 45′ E. long. The boundaries are well marked towards the north, where it is formed by that portion of Mount Taurus which at present goes by the name of Alma Dagh (the antient Amanus), and towards the west, where it is washed by the Mediterranean Sea; the boundaries are ill defined towards the south and east, where Syria is contiguous to deserts, inhabited by nomadic tribes, who sometimes acknowledge the authority of the Turkish sultan, but more frequently disregard his orders and those of his governors. The boundary between Syria and Egypt begins on the shores of the Mediterranean about eight miles south of the town of Gaza, and thence runs south-south-west to a small fortress, called Nakhel, situated in the stony desert, which bears the name of El Tyh Beni Israël. From this place it extends nearly due east across the desert, until it meets the Wady Arabah, which it crosses at the base of a high mountain, called Tor Hesma, which, according to Burckhardt, constitutes the most southern point of the Eyalet of Damascus, or El Sham, and of all Syria. This summit is near 29° 45′ N. lat., or about eight hours' journey from the most northern recess of the Gulf of Akabah, which is the eastern branch of the northern part of the Red Sea. [RED SEA, vol. xix., 344.] From this summit eastward Syria borders on the desert of Arabia, and in these parts the boundary is undefined. It is considered that the steep descent which extends from the base of Tor Hesma east-north-east, and leads from the elevated plain of Arabia Petræa to the low desert of the Nejd, constitutes the boundary between the two countries; but it does not appear that the authority of the Turkish pasha extends to the east of the Hadji route (the great road of the caravans of Mecca), which runs northward through the town of Maan, and the castles of Kalaat el Hassa, Kalaat Belka, and Kalaat Zerka (32° 5′ N. lat.). So far the great caravan-road may be considered as the eastern limit of Syria. Farther north, Syria extends farther to the east, including the plain and mountain-region of the Haouran, which extends to 37° E. long., and perhaps somewhat farther east. Here it borders on the Syrian desert, in which 37° E. long. may be considered as its eastern limit as far north as the parallel of Damascus (33° 32′ N. lat.). From this parallel the boundary is considered to run north-east, passing about 20 miles east of Palmyra, or Tadmor, and striking the Euphrates about 30 miles above Rakka. Here Syria begins to border on El Jezira, or Mesopotamia, from which it is separated by the Euphrates from Racca upwards, to the place where the river breaks through the chain of the Alma Dagh between Bir and Rumkalah. The Alma Dagh mountains divide Syria from Asia Minor. A rough estimate gives to Syria an area of about 70,000 square miles, or about 12,000 square miles less than the extent of Great Britain.

The situation of Syria is peculiar. It is an isthmus which separates a sea of water and a sea of sand. On the west lies the Mediterranean, which extends over more than 40 degrees of longitude, or more than 2000 miles westwards, until it joins the Atlantic. On the east is the desert of Syria and Arabia, which extends to the Gulf of Persia over more than 10 degrees of longitude, or about 600 miles, and when the Gulf of Persia is included, the Indian Ocean is reached at the distance of about 1200 miles from the eastern border of Syria on the south. The isthmus of Syria reaches to the Red Sea, and of the two great branches into which that sea is divided at its northern extremity; the Bahr Akabah penetrates deeply into the isthmus, whilst the other, the Bahr Suez, extends along its south-western border and is separated from the Mediterranean only by the low isthmus of Suez.

The form of the surface is no less peculiar. The central part is furrowed by a longitudinal depression, or wide valley, which extends from its most southern point, the Bahr Akabah, to the base of the Alma Dagh, where it terminates with the lake of Bohhaire (36° 45′ N. lat.). This long valley, which extends over more than seven degrees of latitude, is divided in the middle (between 33° 15′ and 33° 25′) into two valleys by a high narrow ridge of mountains, the Jebel Arbel; and this ridge also divides the waters which run southward from those which run westward and northward. Thus the great valley is divided into two valleys, of which the southern is traversed by the river Jordan on the greater part of its extent, and is considerably below the surface of the sea. The northern valley is drained by the rivers Laettani (Leontes) and Aazy (Orontes). In its most elevated part, near the town of Baalbek, it attains an elevation at which in Europe corn can seldom be grown. The countries on each side of these valleys extend in some parts in elevated table-lands, in other places sunk down into large plains, and again rise into mountains, the summits of some of which are always covered with snow. The changes which the surface and its productive powers undergo in Syria are almost innumerable. We limit our description to the great features.

Southern Syria extends from the southern boundary of the country to 33° N. lat., or, more precisely, to the Bahr el Houle, or Lake Merom (33° 10′ N. lat.), and comprehends the southern valley, and the countries contiguous to it on the west and east.

1. The *Southern Longitudinal Valley* extends from the most northern point of the gulf called Bahr Akabah to the Bahr el Houle more than 250 miles in a straight line, and is naturally divided into three sections by two deep depressions, which are occupied by two large lakes. In the southern depression is the Dead Sea, called by the natives Bahr Lut; and in the northern the lake of Gennesareth, now called Bahr el Tabarieh. The southern part of the valley, or that which lies between the Bahr el Akabah and the Dead Sea, is called Wady el Arabah; the central portion, between the Dead Sea and the Bahr el Tabarieh, Wady el Ghaur, or El Ghor; and the northern, or that part of it which extends from the Bahr el Tabarieh to the Bahr el Houle, is called Wady Seissaban.

The Wady *Arabah* extends from south to north in a straight line for above 110 miles. The existence of this extraordinary valley was unknown in Europe till the publication of Burckhardt's travels (1822), and since that time it has attracted the attention of geographers. Many were inclined to think that, at some remote period, it had served as the channel by which the Dead Sea had discharged its waters into the Bahr Akabah, but it has been ascertained that this can never have been the case, as the level of the Dead Sea is considerably lower than that of the Red Sea. Several barometrical observations had established the fact that the difference in the level of the two seas considerably exceeded 600 feet; but a late traveller, Russegger, who has taken great pains to ascertain the exact amount, has found that the Dead Sea is 1341 French (or 1431 English) feet below the level of the Mediterranean. The watershed between the two seas occurs somewhat north of 30° N. lat., or about 40 miles from the Bahr Akabah. It does not however seem to traverse the valley in a straight line from east to west, but obliquely from south-east to north-west, and thus to occupy several miles from south to north. On each side of the Wady el Arabah the mountains rise to a great elevation. Near the watershed those on the west attain, according to Burckhardt's estimate, 2000 feet; and those on the east rise to 3000 feet. In approaching the Dead Sea they increase in height, which is probably to be attributed to the circumstance that the level of the valley here sinks much lower. The distance between the two mountain-masses varies considerably. Near the two extremities they are only 8 or 10 miles from each other, but towards the middle the valley is 20 miles wide. The surface of the valley presents considerable varieties. South of the watershed it is generally level, but has a considerable slope from east to west, so that near the western mountains it is very little above the sea-level, whilst along the eastern it may be from 200 to 300 feet higher. About three miles from the Bahr Akabah the soil is strongly impregnated with salt, but farther north sand prevails, and is intermixed with pieces of granite, porphyry, and greenstone. After the rains the country produces some grasses, and supplies indifferent pasture for sheep, goats, and camels; but in several places low hills of moving sand occur, which are destitute of vegetation. The watershed appears to be about 500 feet above the sea-level. North of the watershed there are some ridges of low hills running lengthwise through the valley, and dividing it into two valleys. In the western valley during the rains, and a short time after them, there is a stream, called El Jib, which at that season collects all the waters that descend from the eastern and western mountains, and carries them to the Dead Sea. The small rivulets which descend in the narrow valleys by which both mountain masses are furrowed, contain also at other seasons a stream

of running water, but it does not then reach the bed of the El Jib, being lost in the gravel and sand. A few trees of that kind of acacia which produces the gum-arabic, tamarisks, and a few mimosas and shrubs grow among these sand-hills. The Beduins encamp here only in winter, when the torrents produce a copious supply of water, and a few shrubs spring up on their banks, affording pasture to sheep and goats; the camels live on the leaves of the trees, especially the acacia. Water is found even in summer a few feet below the surface. In proceeding farther north, between 30° 30′ and 31° N. lat., the Arabah does not appear to have any considerable descent towards the north, but it is longitudinally furrowed by a narrow valley, in the midst of which is the bed of the river El Jib. This narrow valley gradually sinks lower, so that at its northern termination it is 150 feet below the general level. Its width at the beginning is about one mile, but towards its termination hardly more than half a mile. The dry bed of the river, especially in the narrower part of the small valley, is overgrown with tamarisks, and in one or two places there are a few date-trees, but otherwise this tract is a desert. Near 31° N. lat. the general level of the Wady el Arabah descends abruptly about 150 feet, forming apparently a line of hills running east and west, and composed mostly of marl. All along the base of these hills there are springs of brackish water, which form a tract of marshy land towards the north. Between this salt marsh and the Dead Sea extends the most desolate portion of the Arabah. No trace of vegetation, no living creature is met with. At the base of the western mountains is a low mountain ridge, in general about 150 feet high, which runs for about 10 miles parallel to the Wady Arabah and the southern portion of the Dead Sea, and which is one mass of solid rock-salt, covered with layers of soft limestone and marl, through which the salt often breaks out, and appears on the sides in precipices 40 or 50 feet high, and several hundred feet long. From the base of this chain of rocks, which is called Usdûm, there break out several rills of transparent water, which run to the Dead Sea, but the water is as salt as the saltest brine. The tract between them, the bed of the Jib and the Dead Sea, is a perfect level, and extremely barren; but that on the east of the Jib is traversed by some rivulets descending from the eastern mountains, which have fresh water, and impart to the soil a considerable degree of fertility, so that there are some tracts which are cultivated. That part of the Arabah which lies north of 31° N. lat. is called El Ghor, a name which properly applies to the valley between the Dead Sea and the Lake of Tabarieh.

The Dead Sea occupies the greater portion of the valley between 31° 10′ and 31° 50′ N. lat. According to the most recent maps, the width of this lake does not exceed seven miles. [DEAD SEA.] The mountains which enclose the lake on the east and west are not far from the shores towards its southern extremity, but they recede farther from them towards its northern end. On the eastern side, and about the middle of the lake, the steep mountain-masses come so close to the shores that a steep cliff overhangs the lake for about two miles. The width of the plain along the lake varies from one to four miles, the wider part being towards the northern extremity. The level tract along the western shore is covered with sand, and entirely unfit for cultivation: but on the eastern side, and especially towards the southern extremity, it is in many places very fertile, and is covered with forests, in the midst of which the peasants cultivate dhurra, tobacco, and indigo, and keep cattle. The heat in summer however is so great as to render this low tract almost uninhabitable, which is easily accounted for when it is remembered that the surface of the lake is 1431 feet below the Mediterranean. In summer the people go nearly naked. From this part indigo and tobacco are exported, and also the wool of a species of cotton-tree, and the juice extracted from this tree, which is used in Jerusalem as a cathartic.

The *Ghor* or *Ghaur*, or that portion of the Southern Valley which lies between the Dead Sea on the south and the Lake of Tabarieh on the north, extends about 65 miles in a straight line. The whole of this valley is below the level of the Red Sea, as the Lake of Tabarieh is 666 feet and the ruins of Jericho about 560 feet below it. The width of the valley is about six miles; but towards the Dead Sea it grows much wider. It is traversed by the river Jordan, which is here called Sheriat Kebir. Issuing from the Lake of Tabarieh, the river runs along the western mountains to Bisan, when it turns to the eastern mountains, along the base of which it flows for more than ten miles, and then returns to the western side, but afterwards continues to flow rather in the middle of the valley. The mountains which enclose the valley on the east are steep and high: they are also high and steep on the western side for nearly half the length of the valley, beginning from the south; but farther north they sometimes sink down to low hills, and continue so for several miles. The river flows in a bottom about half a mile wide, and at least forty feet below the general level of the Ghaur. This bottom is overgrown with high trees, and exhibits a luxuriant vegetation of plants and grasses, which present a striking contrast with the sandy and bare slopes which border it on both sides. In winter, the river inundates the bottom, but never rises to the upper plain. This upper plain is furrowed by numerous rivulets, which descend from the mountains and form numerous pools of stagnant water after the rains have ceased. In such places and near them, there is a luxuriant growth of herbage and wild grass, but the greater part of the ground is a parched desert, of which only a few spots are cultivated by the Beduins, who however keep large herds of cattle, sheep, and goats. The most important articles of cultivation are wheat and dhurra, but especially barley, which is exported. Towards the Dead Sea, the bottom of the river is less marked, the slope of the ground from the base of the mountains to its banks being very gradual, but the surface undulating. In these parts the Ghaur has a greater degree of fertility, and produces good crops of grain; but only a small portion is under cultivation. On the banks of the river there are willows, poplars, and tamarisks, and on the higher ground plantations of vines, pomegranates, and nebek-trees and zakkhum-trees (*Eleagnus angustifolius*). South of the ruined village of Richa (Jericho), and as far as the Dead Sea, the valley is nearly level, and the soil consists of clay impregnated with salt, and produces only salicornia, which is collected by the Beduins, as the ashes obtained from it constitute an important article of internal commerce, as many places have soap manufactories. [SALICORNIA.] The climate of the Ghaur is exceedingly hot. It is stated that the crops in the valley are four weeks earlier than at Jerusalem, which is easily accounted for, when the deep depression of the valley is considered, and the elevation of Jerusalem, which is nearly 2500 feet above the sea.

The *Bahr el Tabarieh*, formerly called the Lake of Tiberias and of Gennesareth, occupies about 12 miles of the extent of the valley in length, and about half as much in width. It is surrounded with steep and lofty mountains, except on the south, on both sides of the efflux of the river Jordan, where there is a sandy plain, and except along the western shore, from the town of Tabarieh northward, where an undulating plain, with an average width of a mile, or a little more, intervenes between the mountains and the lake. A considerable portion of this plain is cultivated by means of irrigation, and produces wheat, barley, dhurra, tobacco, grapes, melons, and several kinds of vegetables. Burckhardt is of opinion that all kinds of tropical fruits could be raised here, the heat in summer being excessive; and he observes that the melons ripen four weeks sooner than at Damascus, to which town great numbers of them are taken. Some dates are also grown here, but there are no regular plantations. In the winter some cold is experienced, but frost is rare; snow also is rare. The water of the lake is slightly brackish, and some of the rivulets which descend from the western mountains are salt. There are also hot-springs.

The *Wady Seissaban*, or northern portion of the southern valley, extends from the northern extremity of the Bahr el Tabarieh to the southern banks of the Bahr el Houle, about 15 miles in a straight line. Perhaps one-half of its extent is below the sea-level, as the bridge called Beni Yakoub is 350 feet above the sea, whilst the lake of Tabarieh is 572 feet below it, as already noticed. The river flows in a narrow bed with an extremely rapid current. The higher grounds of the valley, which is here about two miles wide, are partly cultivated; and on the greater part of the cultivated tracts different kinds of vegetables are grown, especially cucumbers and gourds, which ripen three weeks sooner than at Damascus, where the produce finds a ready sale. There are many zakkum-bushes (*Eleagnus angustifolius*) and the thorny rhamnus (*Rhamnus spina Christi*) in the lower part of the valley. The Bahr el Houle, which is at the northern extremity of the valley, and which in the

Bible is called Lake Merom, is not large, and its extent varies according to the seasons. The low country which surrounds it to some extent is only inhabited on the eastern border, where the banks are overgrown with reeds and papyrus plants. The western and south-western banks are covered with a saline crust.

It is the generally received opinion that the Nahr Banias, or the river flowing from the east into Bahr el Houle, is the true source of the Jordan [BANIAS, vol. iii., p. 374], but a much larger river falls into the lake from the north, which originates about 20 miles north of it on the south-western declivity of the snow-covered mountain-mass known by the name of Jebel es Sheikh. Burckhardt calls this river Nahr el Hasbeya: it flows about 10 miles in a narrow valley surrounded by hills, which are planted with olive-trees, but farther south the valley increases to 3 or 4 miles in width, and the greater part of it is under cultivation, producing good crops of grain. This valley also bears the name of Wady Seissaban; and, if this is included, the southern valley is above 270 miles in length.

The course of the Jordan, which traverses the southern valley as far south as the Dead Sea, has been noticed under PALESTINE (vol. xvii., p. 161). Schubert says that its rapidity is nearly as great as that of the torrents of the Alps when they are swollen by the melting of the snow. He says that the width of the river opposite the village of Richa (Jericho), where the pilgrims bathe, does not exceed 100 feet, and its depth is there about 10 feet. The waters are very muddy.

2. The Desert called *El Tyh Beni Israël* (The Wandering of the Children of Israel) belongs partly to Syria and partly to Egypt, as the boundary-line between these two countries lies across it. It extends on the west of the Wady Arabah, and reaches southward to the Jebel el Tyh (29° 10′ N. lat.), which is connected with the extensive mountain-masses of Mount Sinaï. [ARABIA, vol. ii., p. 213.] On the north the Tyh extends to the elevated table-land of Judaea, but in these parts the boundary-line between the desert and the fertile country does not appear to be distinctly marked. It occurs in the parallel of the southern extremity of the Dead Sea. The Tyh is a desert and elevated table-land, whose level above the sea has not been determined, but is estimated at between 1000 and 2000 feet. Along its eastern border its surface is much furrowed by deep watercourses, or wadys; in some parts lower depressions occur. In such places verdure is found in winter, and trees, especially talh-trees, all the year round. Some of the deep valleys are of considerable extent, and are visited by the Beduins in winter with their herds, and in summer for the purpose of collecting gum-arabic, which is carried to Cairo. The higher parts of the table-land have a hard gravelly soil without vegetation; and in many places there are low irregular ridges of limestone hills. The soil is generally covered with black pebbles. Wells are rare, and usually impregnated with sulphur. In the centre of the table-land its surface is much more level, as the wadies are only a few feet below the general level. In these parts also the soil is covered with black pebbles. In all the wadys the coloquintida is found, and there are several holes out of which rock-salt has been dug. Some tracts are sandy, but others occur which consist of a rich red earth fit for culture. In some places trees are abundant, and charcoal is made for the Cairo market.

3. The *Table-land of Judaea* joins the El Tyh on the north, and extends from the parallel of the southern extremity of the Dea Sead to 32° 30′ N. lat., having on the east the Dead Sea and the Ghaur, and on the west the plain of Falastin. The dividing-line between the last-mentioned plain and the table-land is near 35° E. long. The elevation of this table-land diminishes as we proceed farther north. El Khalil (Hebron) is 2877 feet above the Red Sea, or according to Russegger 3026 feet above the Mediterranean; Jerusalem 2667 feet; Nablous or Sichem 1863 feet; and Jenin, on the northern border of the table-land, only 558 feet above the Red Sea. North of 31° N. lat., the desert of the Tyh passes insensibly into a fertile country. The table-land there extends into an undulating plain, occasionally interrupted by low ridges of hills, which in summer are barren, but a part of the year are covered with grass and rich pasture. The lower parts preserve their verdure all the year round. The plain is furrowed by valleys, which sink considerably below the general level, and are full of corn-fields, and vineyards and orchards that produce excellent grapes and figs. Corn-fields are also numerous on the higher grounds, but they are interrupted by large tracts of naked limestone rocks, which come out upon the surface, and cover it to such a degree as to give the country the appearance of a very rocky region. This description applies to the interior of the table-land, as far north as Jerusalem, except that cultivation, and especially the plantations of olives, fig-trees, vines, pistachio-trees, apricots, pomegranates, oranges, and lemon-trees increase as we proceed north. The country is however rather bare of trees. The plains between the limestone rocks are covered with grass, which supplies pasture to sheep and goats, and herds of cattle, horses, asses, and camels. The mountains which form the eastern border of the table-land however, and extend along the Dead Sea, are a picture of desolation; they consist of yellow rocks without the least traces of vegetation. These mountains are distinguished from all other ranges of Syria by their summits, which do not present rounded masses, but rise in the form of pointed peaks and sharp edges, like the summits of the Alps. The barrenness which characterizes this tract extends over the whole table-land in the parallel of Jerusalem; for in this part even the mountains that form the western border of the table-land are comparatively barren, but farther south they are fertile.

North of the parallel of Jerusalem the unevenness of the table-land is much greater, and the hills frequently rise to the height of mountains. Such are the mountains of Ephraim (north of 32° N. lat.), of which however little is known except that they are covered with woods and bushes. The depressions between the hills are of considerable extent, and may sometimes be called plains. The slopes of the surrounding hills are gentle, and generally susceptible of cultivation, which is effected by making terraces on their declivities. At a few places there are valleys, some between the hills, and others formed by the action of the rivers in the more level country. The country is much less naked than it is farther south; at several places forests consisting of high trees occur, and large tracts are covered with bushes. Cultivation is attended to in some degree, but large tracts lie waste. Fruit-trees are very common, and olive and fig trees in some places cover several square miles in extent.

The climate of the table-land of Judæa may be inferred from that of Jerusalem and its vicinity. There are two rainy seasons, each of which lasts seven or eight weeks. The early rainy season sets in about the beginning of November, and lasts till the beginning of January. The late rainy season sets in at the beginning of April and somewhat later. The winter is rather cold, and frost in January and even February is not rare. Snow falls also, and sometimes very heavily. When Browne was there a very deep snow lay on the ground for 12 or 13 days. The late rains prolong the cold season frequently to the middle or end of May, and even to the beginning of June, whilst the early rains, which are commonly accompanied by south-westerly winds, contribute to preserve mild weather to Christmas, which season is considered the most pleasant. The summers are very hot. The thermometer sometimes rises to more than 100°, when the south-east and east winds, which blow from the Arabian and Syrian desert, have continued for several days. They are extremely dry. Schubert thinks that the mean temperature of the summer can hardly be less than 85°. The mean annual temperature, he thinks, must be 60° or somewhat more; and he observes, that neither the date-tree attains its full growth nor cotton can be cultivated with advantage. The mean temperature of Naples is higher than that of Jerusalem, which comes near to that of Cagliari in Sardinia.

4. On the west of the table-land of Judæa is the *Plain of Falastin*, as the antient country of the Philistines is still called by the Beduins. On the south it borders on the desert of the Tyh, near 30° 30′, and advances northward to the base of Mount Carmel, 32° 45′ N. lat., so that its length exceeds 150 miles, but the width varies greatly. It is widest on the south, where it is more than 60 miles across, or rather 120 miles, as it extends to the Isthmus of Suez and to the delta of the Nile. In the parallel of Gaza it is about 25 miles wide or somewhat more, but as the shores of the Mediterranean trend to the east of north, it grows gradually narrower, and towards its northern extremity it is still more narrowed by Mount Carmel, which extends to the west of north. Between the base of this range and the sea the Plain of Falastin is only a few miles wide. The most

southern portion of the plain is a desert, whose surface is composed of sand, diversified by small hills which are produced by the strong winds, and a few wide depressions in the form of valleys, through which in winter-time the numerous watercourses of the Tyh find their way to the Mediterranean. It is certainly worse than the Tyh itself, as it is not visited even in winter time, and there are no trees and verdure in the valleys. In this desolate region the samiel originates, which is frequently experienced in the northern parts of the plain, to which it brings clouds of burning sand. The desert occupies the sea-shore between the delta of the Nile and the town of Gaza, and the sand blown from it into the sea is the principal reason why all the harbours of the Syrian coast as far north as Cape Carmel are choked up, and admit only small vessels. On the sea-coast the desert terminates near Gaza; but at the foot of the table-land of Judaea it extends about 10 miles farther north. The fertile portion of the plain of Falastin consists of a tract extending along the sea, with an average width of 5 or 6 miles, as far north as 31° 40′ N. lat., where it widens so as to reach the table-land of Judaea. A tract with a sandy barren soil, and an entirely level surface, extends along the sea; but farther inland the country is undulating, or interspersed with low hills, between which there often occur cultivable spots which contain plantations of fruit-trees. The most fertile part of the plain extends on both sides of 32° N. lat., and is known by the name of the Plain of Ramleh, or Rama. Though the soil consists of a reddish sand intermixed with some gravel, it has a considerable degree of fertility where it can be irrigated, and produces good crops of grain, and several kinds of fruit, as figs, olives, pomegranates, oranges, and lemons: the water-melons of this tract are of superior quality. There are many date-trees, sycamores, prickly pears, and aloes. The surface of this tract is interspersed with numerous small isolated hills: only a comparatively small portion is under cultivation, for want of water. The most northern part of the plain, or the narrow tract between the base of Mount Carmel and the Mediterranean, has a still better soil, and, where cultivated, produces wheat, barley, and cotton; but a great part of it has been converted into a swamp by the rivulets descending from Mount Carmel, and not finding their way into the sea owing to a series of sand-hills which have been thrown up along the shore by the south-west winds, which prevent their discharge. These swamps make rich pasture for cattle.

5. *Jebel Carmel*, or Mount Carmel, constitutes a remarkable feature in this part of Syria. [CARMEL.]

6. Between Jebel Carmel and the north east corner of the table land of Judaea, which comes close up to the lake of Tabarieh, extends the plain of Merj Ebn Omer, or Amer, the antient plain of Esdraelon. At its eastern extremity, near the mountains on the banks of the lake of Tabarieh, it is only from 5 to 6 miles wide; and in the middle of it rises a round isolated summit, Jebel Tor, or Tabor. [TABOR.] Farther west the plain widens, and between Nazara (Nazareth) and Jenin it is nearly 15 miles wide. Its extent from east to west probably does not exceed 15 miles. At the foot of Jebel Tor the surface is 466 feet above the sea; but it lowers quickly as we proceed westward, so that the greater part of it has a very moderate elevation above the sea-level, as is evident from the slow current of the river Nahr el Mekana (the antient Kishon), which, after a heavy fall of rain, inundates the adjacent country, and converts it into a swamp; but the swamp supplies good pasture for cattle, which in this plain are of a larger size than in any other part of Syria. Though the soil is of considerable fertility, only a small portion of this tract is inhabited. Corn and cotton are grown. Near the base of the hills and mountains surrounding the plain there are forests of evergreen oak, and in these parts there are also plantations of fruit-trees.

7. To the north of the *Plain of Ebn Omer* extends the *Hilly Region of Galilaea*, which is the most fertile part of Southern Syria. The surface presents great varieties. The hills rise with gentle acclivities, and subside into plains several miles in extent, or are separated by wide valleys. The highest hills lie west and north-west of Nazara, which attain an elevation of from 1700 to 1800 feet above the sea. The town of Nazara is in a flat valley on the declivity of a hill, 876 feet above the sea-level. The whole region seems to be fit for cultivation, and a considerable portion of it is cultivated, though there are extensive tracts, especially in the smaller valleys, which are covered with forest-trees. Corn and cotton are extensively grown, and form considerable articles of internal commerce. The olive and fig trees cover considerable tracts. Date-trees do not succeed.

This description applies only to the country south of 33° N. lat. The country north of it, and extending as far as 33° 30′, is entirely unknown, with the exception of the immediate vicinity of the Mediterranean.

8. Along the Mediterranean extends the Plain of Akka, which begins on the south at the base of Jebel Carmel, and extends northward to Ras el Abiad, or the White Cape, a distance of more than 20 miles. Between Jebel Carmel and the town of Akka (Acre) it may be four or five miles wide, but farther north it rarely exceeds two miles in width. The southern and wider portion has a sandy soil in the vicinity of the sea, but farther east it is tolerably fertile and moderately cultivated. In the northern district there are some stony tracts, though in general it is stated that the country possesses a considerable degree of fertility, but nearly the whole is uncultivated.

9. We pass to the east of the Southern valley. The most southern part of Syria is occupied by the extensive table-land of Petraea, which contains the mountain-regions of Shera and Belka, which enclose the Wady Arabah, the Dead Sea, and the Ghaur on the east, and also an extensive plain lying east of these regions, and continuing in that direction to the Desert of Arabia. The southern boundary of this region begins at Jebel Hesma, which marks the most southern point of Syria, and thence runs to the north of east to Akabah es Shamie, on the Hadji road of the Syrian caravan. In these parts it is marked by a steep descent, which leads from the table-land of Petraea to the plain of Nejd in Arabia, which has an arid sandy soil, generally covered with flints. Beyond the Hadji road the natural boundary between the two plains is not known. The Hadji road runs along the eastern declivity of the mountain-regions of Belka and Shera, having on the east a continuous chain of hills called El Zoble: thus the road traverses a long valley, in which several places occur where wheat and dhurra are cultivated, and extensive plantations of vines are found. These articles are easily disposed of by the Arabs to the pilgrims, but the greater part of the valley is not cultivated, owing to the want of water, without which nothing can be grown in these parts of Syria. The El Zoble range terminates on the south at the source of the river Modjeb, and farther south the Hadji road lies within the plain; but dhurra and barley are grown only at a few places, though in several other places, especially at Maan, there are large plantations of pomegranates, apricots, and peaches; with the exception of these isolated spots along the road, the plain is only used as pasture-ground by the Beduins.

The mountain-region of Shera extends from Jebel Hesma to the river Modjeb, from 29° 40′ to 31° 30′ N. lat., between the Hadji road on the east and the Wady el Arabah on the west, and occupies about 20 miles in width. When seen from the Wady el Arabah it has the appearance of a high range, at least 1000 feet higher than the mountains which enclose the Wady on the west, or about 3000 feet above the level of the valley: but when seen from the east, or the great plain, the mountains appear only as hills a few hundred feet elevated above the level of the plain, which shows that the great plain of Petraea is also at a considerable height above the sea. The mountain-region of Shera comprehends three districts, of which the southern properly is called Shera, that in the centre Jebal, and the northern Kerek. The southern part of this region consists of high ridges running generally from south-east to north-west, and separating deep depressions from one another. The ridges are generally flat on the top, but sometimes covered with low hills, which advance eastward into the plain. On the edge of the plain the depressions begin, presenting themselves sometimes as narrow valleys, and sometimes as basins. The largest of these basins is that called El Ghoeyer, which is much lower than the eastern plain, and upwards of 12 miles across at its eastern extremity, but it is narrower towards the west. The surface is rocky and uneven, and it is intersected by numerous glens and by three or four valleys, watered by rivulets, which unite and flow into the Arabah. This basin is noted for its excellent pasture, which is owing to the numerous springs, and is wooded along the rivulets; but there are no woods in the other depressions of this region, nor on the ridges. Villages are rather numerous in these depressions, and are mostly inhabited by Beduin tribes, who have applied

to agriculture, and are industrious. In many parts not only the level grounds are cultivated, but the slopes of the mountains are formed into terraces, which are covered with corn-fields and plantations of fruit-trees. They cultivate wheat, barley, and dhurra, and their orchards contain apples, apricots, figs, pomegranates, olive and peach trees, and numerous vines. Dried figs and grapes constitute the principal articles of export, together with soda. The rivers which traverse this region generally contain water even during the summer, but it is only in winter that the water reaches the valley of the Arabah. The northern part of the mountain-region of Shera appears more in the shape of a table-land: for though it is likewise broken by wadies or glens, they are very narrow, and the country generally extends in wide plains surrounded by low ridges. It contains a much smaller portion of cultivated land than the southern districts, and is equally destitute of trees, with the exception of fruit-trees, which are planted in a few places. The cultivated tracts are chiefly limited to the neighbourhood of the towns of Tafyle and Kerek, and a few villages; but even the nomadic Beduins cultivate some spots which are favoured by a good soil and springs of water. The climate of this region is extremely agreeable. The air is pure; and though the heat is very great in summer, and increased by the reflection of the sun's rays from the rocky sides of the mountains, yet the temperature never becomes suffocating, owing to the refreshing breeze which generally prevails. The winter is very cold, deep snow falls, and the frost sometimes continues to the middle of March. This region would be much better cultivated and more populous if the inhabitants were not exposed to frequent incursions of the Beduins, who live in the eastern plain, and who levy tribute on them, and subject them to many hardships.

The *Mountain-region of the Belka* extends from the river Modjeb on the south to that of Zerka on the north, or from 31° 30′ to 32° 20′ N. lat. Its width between the Dead Sea and the Ghaur on the west, and the Hadji road on the east, rather exceeds 40 miles. The eastern district, or that contiguous to the Hadji road, is little elevated above the road, and constitutes a plain, most parts of which are interspersed with numerous low and isolated hills. Towards the south this plain is sandy or rocky, and in both cases barren; but towards the north it has a chalky or clayey soil, and is covered with a rich verdure in winter. There are no springs in this upper plain of the Belka, and the Beduins have no water except that which is collected in cisterns during the rains. The whole plain is destitute of trees, and generally even of bushes; but some more hilly tracts are overgrown with thick heath. The western districts consist of a succession of ridges and deep valleys opening into the level ground of the Dead Sea or the valley of the Ghaur. The ridges occupy a much larger space than the valleys, and are generally level on the top. In a few places however high hills rise above them. The upper part of the ridges are bare of trees, and generally covered with flints. The narrow valleys between them are always wooded at the bottom, and sometimes on their declivities.

The northern district, or the country north of 32° N. lat., is an extensive mountain-mass, whose highest part is in the middle of the tract, and is called Jebel Julaad (Gilead). This higher ridge extends about ten miles from east to west, and near its most elevated summit, Jebel Osha, is what is called the tomb of the prophet Hosea, which is a place of pilgrimage for Turks and Christians. This mountainous country is almost entirely covered with high trees; oak, wild pistachia trees, and many others not known in Europe. In scenery it resembles a European country. It has numerous springs and small rivers; some of the rivers run underground, as the mountains consist of limestone. On the southern declivity of this tract, and in the vicinity of the town of Szalt, are the only tracts in the Belka which are under regular cultivation, though some other places are occasionally sown with dhurra by the wandering Beduins. The numerous and extensive ruins show that cultivation was formerly carried on here to a great extent, and probably has been discontinued on account of the frequent incursions of the nomadic tribes who live to the east. At present the Belka is considered the best pasture-ground in Southern Syria; and the most powerful tribes of the Beduins are frequently at war with one another for the possession of this region. In summer these tribes remain with their herds in the valleys of the western districts, where the grass never dries up; and in winter they either descend into the Ghaur or encamp on the upper plain. They have few camels, but numerous cows, sheep, and goats. Wheat, barley, and dhurra are cultivated. The vineyards are extensive near Szalt. Sumach and soda are collected; the first is sent to Jerusalem, and 3000 camel-loads of the latter go to Nablous. The climate of the Belka is as pleasant as that of the Shera, and the winters are as cold.

10. The *Belad Haouran* is to the east of the Ghaur. Along the valley it extends from 32° 21′ to 32° 45′ N. lat.; but where it borders on the Syrian desert, which lies between it and the valley of the Euphrates, it advances as far north as 33° N. lat. It consists of two mountain-regions, the Jebel Ajeloun on the west, and the Jebel Haouran on the east, and a plain which lies between the mountain-regions.

The *Jebel Ajeloun* extends about thirty miles south and north, and about as many east and west. It is the most mountainous district of Southern Syria, and the best cultivated to the east of the southern valley. The highest part of the mountains is towards the south, north of the river Zerka (the antient Jabbok), where the mountains of Moerad and of Jebel Ajeloun rise much above the Jebel Jelaad of the Belka. The whole surface is a succession of mountain masses and valleys, and the valleys are rather large: the region is abundantly watered by streams, which either originate in this region or traverse it in its width, flowing from the plain of Haouran to the Jordan. It has great advantages over all the neighbouring countries as an agricultural district, which are still increased by its greater security against the inroads of the Beduins, who find it dangerous to carry on their depredations in a country which contains so many places that can be defended against cavalry. The numerous caverns also, which occur in the limestone rocks, of which the mountains are composed, offer safe retreats from an invading enemy. Wheat and barley are extensively cultivated in all the lower grounds, and in some places on terraces made on the declivity of the mountains. There are numerous plantations of olives and vines. The orchards contain pomegranates, figs, lemons, oranges, and other fruit-trees. Every kind of vegetable is grown. The climate of the valleys is very hot in summer. Burckhardt observed the thermometer at 100° in the shade. The sides of the mountains are chiefly covered with wood, consisting of oak, wild pistachia, walnut-trees, and several kinds not found in Europe.

The *Plain of Haouran*, which extends east of the Jebel Ajeloun, is a level, the northern part of which is frequently interrupted by isolated hills, which however are less numerous towards the south, and at last disappear entirely. Those southern districts have a very sandy soil, and are almost uninhabited. But the northern districts have a soil consisting of a fine black earth, which possesses a considerable degree of fertility, but is very little cultivated. A village is built at the foot or on the declivity of almost every hill, but very few of them are inhabited. Most of them however are in such a state that the greater number of the houses can be rendered habitable with very little labour, and it frequently happens that these habitations are taken possession of by some wandering peasant for a short time. The Haouran peasants do not fix themselves in one place: they wander from one village to another, and they find commodious dwellings in the antient deserted houses. One camel is generally sufficient to transport their family and baggage; and as they are not attached to any particular spot by the possession of land, they have no repugnance to quitting the place of their birth. They are chiefly induced to change by the exactions of the Beduin tribes, who are considered the true proprietors of the plain. The few cultivated spots of the plain occur only on the banks of the rivers which descend from the Jebel Haouran, and in winter-time bring down a great volume of water, which is skilfully employed in irrigating the fields for crops of wheat, barley, or beans. During the winter the plain produces excellent pasture for the herds of the Beduins. There are no trees. The cold in December and January is severe.

The *Jebel Haouran* is much less extensive than the Jebel Ajeloun. It extends from 32° 25′ to 33° N. lat., but no part probably is more than 12 miles across. It is surrounded by plains, which are lower than the base on which the mountains rise; though the cold of the winter proves that they are at a considerable elevation above the sea. The mountain region is covered with several ridges running in different directions. The highest part of the mountain system is near 32° 40′ N. lat., where the Kelab Haouran, a summit

in the form of a cone, rises considerably above the lower ridge on which it stands. It is wooded on the north and west, but bare on the east and south; and this observation applies to the whole mountain-region. In its present state only the northern and western base of this region are inhabited and cultivated, and cotton and tobacco are extensively grown. Wheat, barley, dhurra, and beans are cultivated. The wood with which the mountains are clothed is only stunted oak. In the mountains there are extensive pasture-grounds, even where there are no trees, as at the southern declivity of the region, where a great number of uninhabited villages and towns occur, the houses of which are generally in a tolerable state of preservation. In the month of November the Kelab Haouran was not covered with snow, but at its base Burckhardt experienced a hoar-frost.

East of the Jebel Haouran is the Syrian desert, of which Burckhardt gives the following account. To the distance of three days' journey there is still a good arable soil, intersected by numerous tells (hills), and covered with ruins of villages. Every day five or six are met with. This tract is called El Telloul, from the hills. There are no springs, but water is usually found by digging to the depth of three or four feet. At the point where this desert terminates begins the sandy desert called El Hammad, which extends eastward to the banks of the Euphrates, and southward to the Wady Serhhan. The Wady Serhhan is a deep depression which traverses the great desert between the northern extremities of the Red Sea and of the Gulf of Persia, nearly in the middle, and runs in a south-east direction.

CENTRAL SYRIA extends from 33° 10′ to 34° 40′ N. lat. It comprehends the most elevated portion of the country. Within its limits are the two mountain-ranges of the Libanus and Antilibanus, and the southern and highest portion of the northern valley. To the east of the Antilibanus is the elevated plain of Damascus.

1. *Mount Libanus*, called by the natives Jebel Libnan, constitutes a continuous range of mountains, which begins on the south at the castle called Kalaat el Shkif, south of 33° 20′ N. lat., and, running to the east of north, terminates near 34° 40′ with a ridge of hills called Jebel Shara. The northern portion of the range is called Jurd (*i.e.* Jebel) Baalbec, and the southern Jebel Sanin. As the higher part of the range is destitute of trees, it is considered that its average elevation above the sea must be at least 8000 feet. The highest part of it occurs between 34° 10′ and 34° 15′ N. lat., and is called Jebel Makmel. It rises to more than 12,000 feet above the sea-level, and is covered with snow all the year round. The highest part of the road, which passes over the range to the east and north of the Jebel Makmel, is 7590 feet above the sea. This range of mountains, with its declivities extending eastward and westward, varies between 12 and 18 miles in width in a straight line, of which extent less than one-fourth lies on the east side of the highest crest, so that on this side the declivity is much steeper than on the west, where its offsets generally approach the shores of the Mediterranean, and in a few places, as north of Beirout and at Ras El Shakka, come close to the water's edge. On both sides of the range a terrace occurs somewhat about the middle of its height, which divides the Upper and Lower Libanus. The Upper Libanus usually presents only steep declivities, either entirely bare, or clothed with a scanty vegetation, but a few spots have a fine growth of grass, and in summer they are used as pasture-ground by the mountaineer Arabs who visit this place. The most extensive of these pasture-grounds occurs near 34° N. lat., where there is a level tract near the summit of the range, which extends eight or ten miles in length, and from three to four in width, called Watty-el-Bordj. There are no springs on it, but for the greater part of the year it is covered with snow, and in the latter part of the spring it produces pasture not inferior to the best pasture-grounds on the Alps. The level ground which separates the Upper Libanus from the Lower is also generally without trees, but always covered with shrubs and grass. It contains small groves of cedars, not far from the northern base of Jebel Makmel, more than 6000 feet above the sea-level.

The Lower Libanus, to the west of the range, is one of the most interesting countries in Asia. That part of it which extends from Beirout (33° 50′ N. lat.) to Tarablous (34° 25′) is called Kesrouan, though this name, according to Burckhardt, properly belongs only to the most southern district, which is entirely in possession of Maronites, to the exclusion of Turks and Druses. The Kesrouan is very well watered, as the greater part of the waters collected on the mountain-range descends towards the Mediterranean. The water-courses however lie in very narrow and deep valleys, the sides of which rise with a steep ascent several hundred feet above the narrow level at the bottom. As these water-courses are very numerous, the ridges between the valleys are very narrow, and there is no level on their tops. The traveller no sooner arrives at the summit than he immediately begins to descend. Each hill is isolated, so that to reach a place not more than ten minutes distant in a straight line, one is obliged to travel three or four miles by descending into the valley and ascending on the other side. The valleys, even where widest, never exceed a mile in breadth; but every cultivable spot is turned to account. The inhabitants build terraces on the declivities of the mountains to obtain a space of level ground, and to prevent the earth from being swept down by the winter rains, and at the same time to retain the water requisite for the irrigation of their crops. On these terraces and in the level spots of the valleys there are orchards, mulberry-plantations, vineyards, and fields of dhurra and other grain. The silk which is collected in these places is not inferior to any in Europe, and constitutes the principal article of commerce. The lower ranges and hills, with which the offsets of the Libanus terminate, are covered with plantations of olive-trees, but the narrow plain along the shores of the sea is generally not cultivated, except at the very base of the hills. There are however some small groves of date-trees. The higher part of the ridges which separate the valleys are generally wooded with fir-trees.

The eastern declivity of Mount Libanus differs greatly from the western. As in this part the highest crest of the mountains is near their base, there is no space for the water to form streams. It is therefore only furrowed by ravines, in which the water descends during the rains, with the exception of three or four rivulets, which preserve the water somewhat longer. This part of the Lower Libanus is covered with low oak-trees, the round-leafed and the common English kinds. On the narrow level plain which divides the Lower Libanus from the higher part of the range are some spots which are cultivated or planted with walnut-trees. Higher up the mountain is very steep, and the vegetation is scanty.

2 The *Northern Valley*, as far as it is included within Central Syria, extends along the eastern base of Mount Libanus in all its extent, or about 90 miles in length. Its width differs considerably. South of Baalbec, where the ranges of the Libanus and Antilibanus run parallel, it is only from 2 to 3 miles wide. But north of Baalbec the last-mentioned range declines more to the east, and the valley gradually grows wider. At Baalbec it is about 5 miles wide, and in the parallel of the northern extremity of the Antilibanus (near 34° 25′ N. lat.) more than 10 miles. It is naturally divided into two sections, as the waters of the southern districts run off to the south by the river Lietani (the Leontes of the antients), and the northern portion is drained by the Aazy or Orontes. The two river-basins however are not contiguous, for near 34° N. lat., and chiefly north of that parallel, is a tract about 12 miles in length, the waters of which do not reach either of these rivers, but are lost in the plain. This tract is the most elevated part of the valley; the town of Baalbec, which is built towards the southern border of it, is 3808 feet above the sea-level. The southern and more narrow part of the valley is called the Bekaa. It is watered by the Lietani river, which rises about 5 miles south-west of Baalbec, in a small lake, and traverses the Bekaa nearly in its middle. The river has water all the year round, being supplied by several copious rivulets which descend from the western declivity of the Antilibanus. The course of this river is only known as far as it lies within the Bekaa. Where the valley terminates on the south, near the castle of Kalaat el Shkif, the river turns west, and enters a hilly region which never has been visited by European travellers. It reaches the Mediterranean a few miles north-east of Sur (Tyrus). The Bekaa is famous for its fertility, and Burckhardt informs us that the soil produces usually ten-fold the seed, and in fruitful years twenty-fold. Still he thinks that more than one-sixth of the surface is not cultivated, though the numerous rivulets descending from the Antilibanus afford ample means of irrigation. The greater portion serves only as pasture-ground for the Beduins and Turkmans, who pass the winter here, and ascend in summer to the upper declivities of the Antilibanus. The northern and wider portion

of the valley is called Belad Baalbec. The soil of this tract is not much inferior to that of the Bekaa, but the proportion of cultivated land to that which is only used as pasture, or not used at all, is still less than in the last-mentioned district. Only a few villages occur in the middle of the valley, which, as well as the Bekaa, is destitute of trees; but there are numerous villages at the base of the mountains, especially along the Antilibanus, where small rivulets descend from the mountains and supply the means of irrigating the corn-fields and orchards.

3. The *Antilibanus*, which stands to the east of the valley just noticed, extends much farther to the south than the Libanus. It is divided into two portions by a long and narrow depression across the mountains, which occurs near 33° 40′ N. lat., and is called El Bogaz (the Gorge). The most frequented road from Beirout and Deir el Kamr leads through this depression. The Northern Libanus, or that portion of the range which lies north of the Bogaz, is very little known. It descends towards Belad Baalbec and the Bekaa with a very steep declivity, which is barren and destitute of wood except at a few places where rivulets descend in narrow glens: those glens are overgrown with trees. The eastern declivity of the range has never been seen by European travellers, and it is not known how far it extends, except along the road which passes over the mountain a few miles north of the Bogaz, where the mountains occupy a space of about 10 miles in extent. This part of the range has no great elevation. The highest point of the road is only 3148 feet above the sea-level, and less than 1500 feet above the adjacent plain of the Bekaa. It does not appear that any part of the Northern Antilibanus exceeds 6000 feet in elevation.

The Southern Antilibanus attains a much greater elevation. At the distance of about 12 miles south of the Bogaz an extensive mountain-mass rises to such an elevation, that its summit is always covered with snow: it is called Jebel es Sheik. This mountain-mass and its declivities cover a space of 20 miles from east to west. From the western declivity branches off a narrow ridge, which, towards the north, is called Jebel Arbel; but its southern prolongation is known by the name of Jebel Safed: it terminates on the south with the elevated mountains which lie to the north of the town of Safed: its length is about 35 miles. This range is very little known. South of the summit of the Jebel es Sheik lies an extensive mountain-tract, extending about 15 miles east and west, and as much to the south. It is mostly covered with thick wood, and only used as pasture-ground. From this mountain-region a ridge runs southward, which is called Jebel Heish, and which terminates with a hill, called Tel el Faras, in the elevated plain of Jolan, about 5 miles south of 33° N. lat. The two ridges of the Jebel Safed and of the Jebel Heish enclose that part of the valley of the river Jordan which lies north of the lake of Tabarieh, and is called Wady Seissaban. The direct road leading from Jerusalem to Damascus crosses the narrow ridge of the Jebel Heish about 12 miles north of the Tel el Faras, and at this place it is perhaps not more than 500 feet above its base: but the plain on which it stands is from 3000 to 3100 feet above the sea-level. The mountains are covered with forests of small oak.

4. The *Plains of Damascus* lie on the eastern side of the Antilibanus, surround its southern ridge, the Jebel Heish, and extend as far south as the Haouran. They form an intermediate terrace between the mountain-region and the low Syrian desert, which is farther east, and is much lower than the plains. At their southern extremity, where they border on the Haouran, these plains extend to a distance of 70 miles from the range; but farther north their width is less. In the parallel of Damascus they are only 30 miles wide. North of Damascus the boundary diverges towards the east; but in these parts it cannot exactly be determined, as the desert sometimes approaches near the caravan road leading from Damascus to Aleppo, but generally remains at a considerable distance from it. It appears that many cultivable though uncultivated tracts occur as far east as Tadmor [PALMYRA], which is about 75 miles from the range of the Antilibanus.

The lowest part of these plains is about 12 or 15 miles east of Damascus, where an extensive lake, or rather swamp, occurs, called Bahr el Merdj, in which several rivers are lost which descend from the eastern declivity of the Antilibanus, and from the Jebel Haouran, from north, west, and south. The most remarkable of these rivers is the Barrada, which brings down all the waters collected on the eastern declivity of the Antilibanus between 33° 15′ and 33° 50′ N. lat. These waters unite at some distance from the foot of the range, in a wide depression of the plains, called El Gutha, in which the town of Damascus is built, and which is the most productive spot in Syria, if not on the globe. Burckhardt says that the gardens and orchards surround Damascus to the distance of 6 to 10 miles; and Schubert estimates the area which they cover at 130 or 150 square miles. The cultivated fields surrounding this forest of fruit-trees extend to a farther distance of some miles. The astonishing fertility of this tract is produced by the abundance of water, as the country is traversed by seven branches of the river Barrada, which always yield a copious supply of water for irrigation. The gardens contain all the fruit trees of Southern Europe, and also the Rhamnus lotus. Apricots are more abundant than other fruits; and considerable quantities of dried apricots, and a jelly made from them, are sent to Aleppo and all over Syria, and the countries bordering on the Euphrates. The plantations of walnuts, pistachia-trees, and the vineyards are also extensive. The wine is of first-rate quality. Every kind of grain grown in Europe is cultivated, except rice: dhurra is grown to a small extent. Other objects of cultivation are cotton, flax, hemp, madder, and tobacco. The castor-oil plant is cultivated for the oil. Pulse and vegetables of every kind are cultivated successfully. As the town of Damascus is 2337 feet above the level of the sea, the climate is far from being so temperate in winter as it is commonly supposed to be. Many of the more delicate fruit-trees sometimes suffer from severe frosts.

The most western portion of the plain, or that which extends between the southern extremity of the Jebel Heish and the Jebel Ajeloun, and from the lake of Tabarieh eastwards to the Hadji road, is called the Plain of Jalon. The ascent from the lake of Tabarieh is very steep and long. The surface is uneven and undulating, and there are a few isolated hills. Several considerable tracts have their surface formed of rocks, which are commonly covered with a thin layer of earth, on which grass springs up after the rains, but which are quite bare at other times. Other districts however have a fine soil, either black, grey, or red, and some produce rich crops. The greater part of them however is uncultivated and overgrown with a wild herb, on which cows and camels feed.

The plains extending east of the Hadji road, south of El Gutha, are rather hilly in the northern districts, short and low ridges running in different direction. These parts contain several stony tracts, and others which might be cultivated, if water was abundant. The greater part is at present only used as pasture-ground. The southern districts, or those which approach the northern extremity of the Jebel Haouran, contain too extensive rocky regions, called El Szaffa and El Ledja, which are divided from one another by a wide valley, called El Lowa. The Ledja, which lies to the west of El Lowa, is somewhat elevated above the general level of the contiguous plain. It is a level country with a stony soil, covered with heaps of rocks, among which are small patches which produce excellent pasture for the cattle of the Arabs. In the centre of the Ledja the ground is more uneven, the pasturing-places are less frequent and the rocks higher. This tract covers an area which extends from two to three days' journey from south to north, and one day's journey from east to west. The Szaffa, which is east of the Lowa, resembles the Ledja, except that the rocks with which it is covered are considerably larger, although the whole may be said to be even ground. There are no springs and no cisterns. This tract is two or three days' journey in circumference. The Lowa is a valley which separates the Ledja from the Szaffa, and is traversed by the river Lowa, which originates in the Jebel Haouran and falls into the Bahr el Merdj. On its banks is a plain of considerable extent, which is covered with the most luxuriant herbage, and was formerly well cultivated, as is proved by the ruins of numerous villages and towns in the valley. But at present it serves only as pasture-ground for the Beduins, who occasionally cultivate some spots with dhurra.

That part of the Plains of Damascus which lies north of the Gutha is only known where it is contiguous to the road running from Damascus to Aleppo. The road passes over two low ridges, which appear to be connected with the Antilibanus. The country through which it passes is in a few places covered with sand, but in general it has a rich culti-

vable soil, free from stones and sand, though, like all the plains of Damascus, it is destitute of trees and even of shrubs. Villages and cultivated tracts occur only at great distances. The Beduin tribes who inhabit the Syrian desert probably prevent the extension of agriculture.

NORTHERN SYRIA comprehends that portion of the country which lies north of 34° 40′ N. lat. It differs in physical constitution from the more southern parts. A high mountain-range runs along the shores of the Mediterranean, and in some places close to them. At the back of it is the northern portion of the Northern Valley, which is divided by a hilly tract, extending from south to north, from the Eastern Plains.

1. The *Mountain Region* of Northern Syria is divided into two portions by the lower course of the river Aazy. The southern part, which comprehends about two-thirds of the whole, is known by the name of Jebel el Anzeyry, and the northern by that of Jebel Ahmar.

The Jebel el Anzeyry is divided from Libanus by a gap or depression, which extends between 34° 40′ and 34° 50′ N. lat., and is nearly 10 miles across. It is a low plain, called El Junie, which is nearly a dead level. Numerous torrents descend from the contiguous mountain-ranges, especially the Jebel Sharra, or northern extremity of Mount Libanus, and when copious rains fall in the mountains the plain is converted into a swamp. It is therefore uninhabited, and only used as pasture ground by the Turkmans and Kurds who inhabit this part of Mount Libanus.

The Jebel el Anzeyry occupies with its branches the whole tract between the Mediterranean and the Northern Valley, and is in width about 20 miles or somewhat more, except towards the southern extremity, where one of its offsets branches off eastwards, and terminates on the banks of the river Aazy, near the town of Hamah. It is called Jebel Erbayn. In this part the Jebel el Anzeyry is about 45 miles wide. The highest part of the range lies in general close to the valley of the Aazy, so that the space between it and the sea is filled up by numerous offsets, which sink down to low hills and enclose valleys of moderate extent. The principal chain terminates east of the town of Antakia, in the great bend of the Aazy. Where it terminates, it is connected with another chain of mountains, which rises a few miles north of the town of Latakia, and runs so close to the shores of the sea, that no road can be made along its western base. The declivities towards the sea are extremely precipitous and barren. It is the Mons Cassius of the antients, and is now called Jebel Akrah, or Okrah. It attains an elevation of 5318 feet above the sea. When the Jebel Akrah meets the Jebel el Anzeyry, it forms a table-land of some extent, which is covered with grass, but without trees. The elevation of the Jebel el Anzeyry is not known, but it never much exceeds 6000 feet above the sea-level. Its eastern declivity is generally very steep, and only covered with shrubs and low trees, but the western declivity is clothed with fine trees, and the wide valleys which lie between its offsets are cultivated with as much care as those of Mount Libanus. Orchards and plantations of mulberry-trees cover a great part of these valleys.

Jebel Ahmar, or the northern portion of the mountain-region, begins on the Mediterranean, occupying the space between Ras-el-Kanzier (36° 20′ N. lat.) on the north, and Jebel Musa, the Mons Pierius of the antients (36° 8′ N. lat.), on the south. Near Ras-el-Kanzier the summit called Jebel Keserik attains 5550 feet above the sea-level. From this summit the range runs north-east, but by degrees turns more to the north, so as to enclose the Gulf of Scanderoon on the east with a curved line. It joins the Alma Dagh about 10 miles north of 37° N. lat. Near 36° 30′ the road between Scanderoon and Antakia traverses it, and the most elevated pass is 4068 feet above the sea-level. This range never exceeds five miles in width. The mountains generally descend towards the Gulf of Scanderoon with a gentle declivity, and approach near its shores, except towards the north, where a level tract about two miles wide intervenes, which gradually increases to the breadth of seven miles. This wider part is fertile and cultivated, and it is diversified with orange and lemon groves. The remainder is almost entirely uncultivated, but full of ruins.

2. The northern portion of the *Northern Valley* begins at the termination of Mount Libanus (34° 40′ N. lat.) and Mount Antilibanus (34° 20′ N. lat.). North of these places a level country extends across the whole breadth of Syria, from the Mediterranean to the Euphrates, which is only interrupted in the eastern plains by ranges of low hills. The plain contiguous to the river Aazy and to the caravan-road leading from Damascus to Hems presents only a few gentle ascents and descents, except along the river, where the descent to its bottom appears to be continuous. It is quite destitute of trees; and though a great part of it is fit for cultivation, the extent of the cultivated tracts is small, and their number not great, which is mainly owing to the want of water.

The Jebel el Anzeyry begins in 34° 40′ N. lat., and on the plain extending east of the river Aazy a ridge of hills called Jebel el Aala rises near 35° N. lat. This last-mentioned ridge runs from south-east to north-west, and thus approaches the Jebel Erbayn, or eastern offset of the Jebel El Anzeyry, south of the town of Hamah, near 35° 5′ N. lat. From this point the river Aazy runs in a narrow valley, which is enclosed by rugged mountains, and which Burckhardt compares with that of the Wye in Monmouthshire. The valley however widens in some parts, and in one of these plains the town of Hamah is built. The length of this narrow valley is about 12 miles. At the northern extremity of this valley the eastern ridge sinks down to the level of the plain, but two or three miles farther north it rises again under the name of Jebel Shachsabon, and here begins that fine valley which is called El Ghab, and which is about 35 miles in length: its width is about 5 miles, but it grows narrower towards the north. The river flows near the base of the Jebel El Anzeyry, where it forms numerous marshes. In winter it inundates the level ground, through which it flows and leaves many small lakes. The valley is also watered by numerous rivulets which descend from the adjacent mountains, and contain water all the year round, a circumstance which gives this valley a great advantage over that of the Bekaa. The villages are pretty numerous, and mostly built at the base of the mountains: they are surrounded by fields, on which dhurra and wheat are grown. The remainder is used as pasture-ground for cattle and buffaloes. The swampy ground being favourable to buffaloes, large herds of them are kept there. In summer the cattle are brought to the Jebel Shachsabon, which is always clothed with excellent grass. The springs which flow from these mountains to the Ghab never dry up, and scarcely even diminish during the height of the summer. The wider valley of the Ghab terminates at Jebel Shogher, and hence the Aazy runs northward in a narrow valley, which contains very little land fit for agriculture; but the sides of the mountains are covered with plantations of fruit-trees: those of mulberry-trees and olive-trees are very extensive.

Where the Aazy emerges from this valley, and, turning north-west and west, flows along the base of the Jebel El Anzeyry, an extensive plain opens to the north, the antient plain of Antiochia, now called El Umk, which stretches to the base of the Alma Dagh. It is about 35 miles long, with an average width of 15 miles. Towards the middle of the plain is a deep depression, which receives all the rivers that descend from the mountains surrounding it on the east, north, and west, and form an extensive lake, called El Bohhaire, the antient Lake of Antiochia. It is about 12 miles long and 6 miles wide, and noted for its eels, which form an article of commerce. The country surrounding the lake rises in very gentle slopes towards the base of the Alma Dagh. The rivers which descend from them run in flat narrow valleys. The northern part of the valley is cultivated, and produces wheat, barley, and several kinds of pulse. The base of the surrounding mountains was formerly covered with trees, but the woods have been destroyed. The Lake of Bohhaire discharges its waters into the river Aazy by a navigable channel, called Kara-su (Black River), which runs south-south-west through the southern and lower part of the plain, which is entirely level, and for the greater part of the year nearly a swamp. No part of it is cultivated, and it is only used as pasture-ground.

The Umk constitutes the most northern portion of the Northern Valley, which is connected with the Mediterranean by the valley in which the Aazy reaches the sea by a west-south-west course. This last-mentioned valley is nearly 30 miles long, and from 4 to 6 miles wide between the Jebel el Anzeyry and the Jebel el Ahmar. The river runs near the base of the Jebel el Anzeyry, and on its northern banks is an undulating country, generally well cultivated. Much tobacco is grown, and the plantations of mulberry-trees are extensive: other fruit-trees also abound

The river Aazy, called by the antients Orontes, rises in the Belad Baalbec, between the Libanus and Antilibanus. Its true source is still disputed. Buckingham places it between 34° 20′ and 34° 25′ N. lat., in a valley of Mount Libanus; but Barker (*London Geogr. Journal*, vol. vii. 100) places it at the base of the Antilibanus, near 34° 15′, where a copious spring issues from a natural basin in the rock. He observes however that the river Labweh unites its waters with the stream formed by the spring. The Labweh rises about 10 miles farther south, in one of the narrow valleys of the Antilibanus, which is about 12 miles to the north-east of Baalbec, and must therefore be considered as the true source of the Aazy. The Aazy drains the northern part of the Belad Baalbec, where it receives a considerable supply of water by the streams which come down from the eastern declivity of Mount Libanus. After having entered the plain north of the mountain-ranges, it falls into a lake, called Bahr el Kades, which is about six miles long and two wide, and by some travellers is considered as artificial. So far the river runs north-east, but it then turns north, and surrounding the base of the Jebel Erbayn by a great bend, enters the valley and runs first north-west and then north, until, in approaching El Umk, it gradually declines to the west and west-south-west, in which direction it reaches the sea near the village of Sweïdiyah. It is not navigated, but it is said that it could be rendered navigable for boats as far as Murad Pasha, on the lake of Antakia, 27 miles above Antakia, though its current is rapid below Antakia, the fall not exceeding five feet and a half per mile. Its mouth is obstructed by a bar, over which there is from three and a half to nine feet of water in winter. Part of the country through which the river flows is fertilised by its inundations, and other parts are supplied by it with the means of irrigation. The whole course of the river probably exceeds 200 miles.

3. The *Hilly Region*, which extends to the east of the valley of the Aazy and of the El Umk, from the town of Hamah to the base of the Alma Dagh, may occupy about 10 miles in width, south of 36° 10′ N. lat., but where it is contiguous to the El Umk it is more than twice as wide. The southern portion has somewhat the form of a range, the limestone rocks rising to a considerable elevation, and enclosing valleys. But many of these hills are only covered with bushes, and the arable grounds are not extensive. Barley and dhurra are grown. Vines are much cultivated, and grapes and debs are sent to Aleppo. The northern portion of the Hilly Region does not present high and steep ridges, but is rather an undulating country on a large scale. The hills indeed rise to a considerable height, their higher parts being about 1700 feet above the sea, but probably not 500 feet above the base on which they stand; and their slopes are gentle, and the depressions between the higher ground so wide, that they constitute rather plains than valleys. There are no watercourses, as the limestone rock absorbs all the moisture. The country however is rather fertile, and yields good crops of wheat and other grain, and cotton of excellent quality. On the hills there are plantations of fig-trees and olive-trees. There are no natural woods except shrubs.

4. The *Eastern Plains* occupy about two-thirds of the surface of Northern Syria, and extend from the Hilly Region to the banks of the Euphrates. They are divided into two parts by a ridge of low hills, called Jebel Allahhs, or Elahas. This ridge is near 35° 50′ N. lat., and appears to extend from the hills north-west of Hamah to the vicinity of the Euphrates: it is very little known, as it traverses a country little visited by Europeans. The same observation applies to the southern part of the plain, which contains in the west large tracts of good soil, which cannot be cultivated for want of water: towards the east it gradually passes into a desert, which occupies the greater part of it, and is divided from the Euphrates by a wooded tract several miles wide, and called El Zawl, or Gharabat.

The northern part of the plain is of a different description. It is traversed by three rivers, two of which rise on the southern declivity of Alma Dagh, and run southward. The river Sajur drains the north-eastern portion of the plain. It rises north of the town of Aïntab, brings down a great volume of water from the mountains, and falls into the Euphrates about 20 miles below Bir, after a course of about 80 miles. The Kowaik, or Kuaik, also called the River of Aleppo, because it passes near that town, rises in one of the great offsets of the Alma Dagh, and runs with numerous windings through the plain southward, until, in approaching the Jebel Allahhs, it is lost in swampy ground, similar to that of the Bahr el Merj near Damascus. This swamp is called El Matkh, or El Ghawas. The third river, called Zeheb, rises in a ridge of hills which run west and east, and terminate on the banks of the Euphrates south of the mouth of the Sajur. These hills compel the last-mentioned river to join the Euphrates. The Zeheb runs southward, and, after a course of about 40 miles, falls into a salt lake called El Sabkh, which is surrounded by low rocky hills. The lake is about six miles long and two wide. After the rains it inundates the narrow strip of land which, in summer, lies between its banks and the rocks, and when the water has been evaporated by the heat of the summer, this narrow strip is covered with pure salt, in some places two inches thick. This salt is collected in the month of August, and extensively used over a great part of Syria. The river Zeheb constitutes the boundary between the desert and the cultivable portion of the plain, as that part of it which lies east of the river has a sandy arid soil, and is considered as forming the most northern portion of the Syrian Desert. The surface of the plain is far from being level. Short ridges of low hills occur at several places, especially near Aleppo, the plain of that town being enclosed by such ridges on three sides. When the plain extends in a level, or in slight undulations, as is mostly the case, isolated hills, called 'tells,' are frequent. Burckhardt considers them to be artificial mounds. In their neighbourhood there are wells and villages. The soil of the plain varies greatly in its productive powers. East and south of Aleppo it is very stony, and the earth which covers the rocks is too thin to maintain moisture for a long time, and therefore is not productive. The soil of the plain to the west and south-west of Aleppo is better, especially in the neighbourhood of the hilly range, where it yields abundant crops of wheat and other grain. To the north-west and north of Aleppo the soil is indeed stony, but the earth is deeper, and cultivation is rather extensive. In many parts now lying waste it could be cultivated with advantage, which is proved by the great number of ruined villages which occur in these parts. The best part of the plain appears to be that which is contiguous to the road leading from Aleppo to Aïntab, especially towards the base of the Alma Dagh, where it is well watered, and yields more than one crop annually, though it is also stony. These plains in general do not sink below 1000 feet above the sea-level, except as we approach the Euphrates. Where they were crossed by the Euphrates expedition, between Aleppo and Aïntab, the surface of the Kowaïk was found to be 1263 feet above the Mediterranean, and that of the Sajur 1363 feet. The Euphrates, below Bir, is only 628 feet above that sea.

The climate of the plains, and especially that of the town of Aleppo, may be compared with the climate of Rome, though the difference in latitude amounts to more than five degrees and a half. The winter lasts about 40 days, from the 12th of December to the 20th of January. There is generally some frost, but it is slight, and the snow seldom rests more than one day on the ground. In February the vegetation is vigorous, and the trees are in blossom; but the spring soon passes, and at the end of May nearly all the smaller plants are dried up, and the whole country begins to look bare, with the exception of trees and bushes. Before May, showers occur occasionally, but after that time it does not rain, and rarely a cloud passes over the clear sky. The first rains occur about the middle of September, and are followed by settled and pleasant weather, which lasts from twenty to thirty days; but towards the end of November the later and more heavy rains set in, and continue to the beginning of the winter. In summer the heat is very great, but not insupportable, as strong westerly winds sweep over the plain and cool the air. Sometimes an easterly wind continues for four or five days, and though it does not produce the effects of a samiel, it imparts to the air a very great degree of heat. The inhabitants shut the doors and windows of their houses, and cannot stir out.

5. The *Alma Dagh* constitutes a portion of that extensive mountain-range which the antient geographers called Taurus. The Alma Dagh is the antient Amanus. It lies along the boundary of Syria and Anatolia, and its crest is considered as the boundary between these two countries. The range occupies in width about 30 miles, of which the larger portion belongs to Anatolia. The mountains are very

precipitous, and can only be traversed by beasts of burden in a few places. The most frequented road runs from Aleppo due north to Aintab, and thence over the Alma Dagh to Kaisariyeh and Angora. There are said to be two or three mountain-roads farther west, in the valley of the river Afrin, the largest of those streams which fall into the Bohhaire, or Lake of Antiochia. The mountains are well wooded. Many thousand acres are covered with large cedars, and in other places there are firs and juniper trees.

Climate.—Syria, though situated within the temperate zone, exhibits all the climates of the globe. The lower part of the Ghaur, which is more than 1000 feet below the sea-level, and is enclosed by high mountains, probably has a mean annual temperature not lower than that of the equator, whilst the most elevated parts of Mount Libanus and of the Jebel es Sheik are covered with snow all the year round. But no regular meteorological observations have been made in any part of Syria. Syria is subject to very violent earthquakes. In 1837 the southern districts were laid waste by a very violent earthquake, by which several towns were destroyed. (*London Geogr. Journal*, vol. vii., p. 101.) At other times the northern districts have suffered. In the country surrounding the Dead Sea there are many traces of volcanic action. Hot springs occur in numerous places, and in others there are depressions which have the appearance of craters. Burckhardt also mentions several hot springs in the mountains which enclose the Umk on the north-east; and Pococke states that an extinct volcano exists in the mountains between the mouth of the Aazy and the Gulf of Scanderoon, which however has not been noticed by more recent travellers. If this volcano really exists, it would constitute the most eastern point of the volcanic region which extends over the Mediterranean between 36° and 42° N. lat.

Productions.—Wheat and barley are the principal kinds of grain which are cultivated, except in those parts which have too arid a soil, where dhurra is almost exclusively grown. Three kinds of dhurra are grown, dhurra gaydi, dhurra sayfeh, and dhurra dimiri. Spelt is much cultivated in the southern district, but very little oats, and no rye. Schubert however found wheat, barley, and rye growing wild in the plain of Ibn Omer, and hence he concludes that rye must formerly have been an object of cultivation in these parts. Rice is only cultivated on the banks of the Bahr El Houle and in the Wady Seissaboun. The most common pulse are peas, lentiles, the Egyptian bean, the *gishrungayga* (Phaseolus Mungo), and the gilban (Lathyrus sativus). Of other vegetables, three kinds of hibiscus are grown, especially Hibiscus esculentus and Hibiscus praecox: also artichokes, melons, especially water-melons, cucumbers, and pumpkins. Potatoes are only cultivated in some valleys of Mount Libanus, and capsicum in the southern districts.

The cultivation of cotton is very general, especially in the northern provinces, where it is of good quality. Hemp is much cultivated in some parts, but flax only in a few places. Madder is grown in Central and Northern Syria, and indigo in the Ghaur and on the eastern banks of the Dead Sea, but only to a small extent. The cultivation of sesamum and of the castor-oil plant is much attended to: the oil of both is generally used for burning. Tobacco is grown in many places; and in some, especially along the sea north of Akka, it is of excellent quality, and furnishes a considerable article of export to Constantinople and other countries.

The cultivation of fruit-trees is much attended to. Some kinds cover large tracts, as the fig on the northern portion of the table-land of Judaea, the olive along the coast of the Mediterranean and in the neighbourhood of Damascus, the mulberry-tree on the western declivity of Mount Libanus and the Jebel El Anzeyry, and the pistachia-tree on the stony hills surrounding Aleppo. Vineyards are numerous in the more mountainous districts, and also on the table-land of Judaea. The wine made on Mount Libanus is of excellent quality. Dried grapes and debs are considerable articles of internal commerce. Other fruits are almonds, apricots, peaches, pomegranates, oranges, lemons, apples, and pears. Dates are at present found in abundance only in the Plain of Akka: at Jericho, the dates of which were formerly celebrated, only a few trees occur. The zakkum and storax are grown in the gardens. The most remarkable trees, which are partly cultivated and partly grow wild, are the sycamore, carob-tree, the Indian fig, the mulberry, and the pistachia-tree.

The forests on the mountains consist of cedars, firs, and pines. Those of the table-lands chiefly consist of several kinds of oak, which however do not attain a large size. They produce however the best galls that are known. There are also the azerol (*Crataegus azerolus*), the walnut, the strawberry-tree, the laurel, terebinth, Juniperus Sabina, and Juniperus Phoenicea. Much scammony and sumach is gathered in the forests of Mount Libanus as articles of export.

The domestic animals which Syria has in common with England are horses, cattle, asses, sheep, and goats. Few horses are kept by the agricultural population; but the wandering tribes, the Arabs, Turkmans, and Kurds, pay great attention to the breed of horses. The breeds of the Arabs and that of the Turkmans are different: that of the Kurds is a mixture of the two. The Arabian horses are noted for beauty and speed. The number of cattle is comparatively small, and, except in a few places, of small size. The asses and mules are of a large breed, and they serve as substitutes for horses in the transport of goods. Sheep and goats are very numerous. In many parts, especially in Northern Syria, that species is kept which has the large broad tail: there are camels and buffaloes. Camels are found everywhere, even on Mount Libanus, on pastures which are more than 6000 feet above the sea. Some of the Beduin tribes whose pasture-grounds are indifferent, which is the case with most of those who live to the east of the Dead Sea, have no animals except camels, and live on their produce exclusively. Two breeds of camels are distinguished. Those of the Turkmans, which pasture at the foot of the Alma Dagh, are larger, and generally carry a weight of 800 pounds; while the Arabian camels carry only 600 pounds. But the Arabian camels bear heat and thirst better than the Turkman camels, and are content with coarser food. Buffaloes are only found on the sea-coast, between Beyrout and Tarablous, and in the Wady Ghab. Those which are kept on the sea-coast are much larger, and not inferior to those of Egypt.

Beasts of prey are not numerous, with the exception of jackals, foxes, and hyænas, which are frequent in some parts of the desert mountains. There are bears on Mount Libanus and Antilibanus. Wolves are only found in the forests of Alma Dagh. Wild boars are very numerous in many parts. Deer are met with on the Alma Dagh and near Mount Tor; and in the desert parts are several kinds of antelopes: the most common is the Antelope hinnuleus. In the mountains of the Belka the bouquetin of the Swiss and Tyrol Alps (Capra ibex) is said to be very numerous. Hares and porcupines abound, and the dipus jerboa is common in the southern deserts. There are several varieties of eagles. Partridges and pigeons abound in many parts, especially on Mount Libanus. In the mountains east of the Southern Valley there are immense numbers of a bird called katta, which is considered to be the Tetrao Alkatta. Several kinds of fish and shell-fish are found in the Mediterranean, but not in large quantity; but a considerable fishery is carried on in an inland lake of the Ghab, where a fish, called black fish (Macropteranotus niger), is so abundant, that annually, between October and January, a great quantity is taken, cured, and sent to remote places. This fish is from five to eight feet long. Fish are also very abundant in the Bohhaire. In the Mediterranean is the Ianthina fragilis, or common purple shellfish. The tortoise, (Testudo Græca) occurs frequently on the table-land of Judaea, and turtles in the Barrada, or River of Damascus. None of the snakes are considered to be poisonous. Bees are very abundant on Mount Libanus, whence wax and honey are exported. The rearing of silk-worms is carried on to a great extent on the mountainous tracts near the coast, and silk constitutes the most important article of export from Syria. The locusts frequently lay waste the fields: the Arabs eat them, and salt them for food. There are no metals found in Syria except iron, which is worked in the Kesrouan in Mar Hanna, west of Beirout, where also coal has lately been discovered. Burckhardt found iron and quicksilver at the western base of Jebel es Sheik. Salt is got from the lake called El Sabkh, and also from the sea-water of the Mediterranean. In the Tyh Beni Israël, and at the southern extremity of the Dead Sea, there are mountains almost entirely composed of rock salt. Bitumen, or asphaltum, is collected on the west shores of the Dead Sea. Burckhardt was told that it comes from a mountain on the eastern side of the sea, and south of Wady

Mojeb. It oozes from fissures in the cliff, and collects in large pieces on the rock below, where the mass gradually increases and hardens until it is rent asunder by the heat of the sun with a loud explosion, and falling into the sea is carried by the waves in considerable quantities to the opposite shores. This will explain a passage of Tacitus (*Hist.*, v. 6), where he speaks of asphaltum being collected on the Dead Sea. It constitutes an article of export. In the northern Ghaur pieces of native sulphur are found at a small depth beneath the surface.

Inhabitants.—The population of Syria consists of agricultural and nomadic tribes. Nearly all the 'Fellahs,' as the agricultural population of Syria is called, belong to one race, resembling in the structure of their body the Beduin Arabs, and speaking also the Arabic language. There is indeed, as Burckhardt observes, a difference between the Fellahs and the Beduins, which is easily observed in the adults of both nations. The Arabs are generally of short stature, with a thin face, scanty beard, and brilliant black eyes; the Fellahs are taller and stouter, with a strong beard and a less piercing eye. But this difference seems chiefly to arise from their mode of life; for the youth of both nations at the age of sixteen have precisely the same appearance. The Fellahs however are divided, according to their religion, into Christians, Jews, and Turks. Under the last name all the Mohammedans are comprehended: the greater part of them are descendants of Arabs, true Turks being only found in Northern Syria, and few in number. The Jews are numerous in Southern Syria, west of the southern valley, but they are rarely found east of that valley, or in the other parts of the province. They are most numerous in the vicinity of the five holy cities, Jerusalem, Tabarieh, Safed, Nablous, and Khalil (Hebron). The Christians are found everywhere. Even in the Haouran the Christians constitute one-fourth of the agricultural population. They are either of the Greek church or Roman Catholics. The Maronites, who have joined the Greek Latin church, constitute a peculiar sect [MARONITES, vol. xiv., p. 438]: they live exclusively on the western declivity of Mount Libanus, in the Kesrouan, and are a very industrious people. Among the Mohammedans is a sect called Metawelis, which is distinguished by fanaticism and intolerance: they are most numerous in the Bekaa and the Belad el Baalbec.

There are also three religious sects in Syria, which are neither Christians nor Mohammedans, the Druses, Anzeyrys or Nossaïrics, and the Ismanlies. The most powerful of them are the Druses, who indeed pay tribute to the Turkish pashas, but otherwise are independent, and their chief may be considered as the master of the whole of Mount Libanus, with the adjacent districts of the Bekaa. [DRUSES, vol. ix., p. 160.] The Anzeyries, or Nossaïrics, inhabit the mountain-region which has received its name from them, and which lies between the lower course of the Aazy and the Mediterranean. They are likewise an industrious people. The Ismanlies are few in number, and inhabit some villages in the mountains of the Anzeyry. They are considered to be a remnant of the Assassins and Ismaelites. [ASSASSINS, vol. ii., p. 494; ISMAELITES, vol. xiii., p. 46.] Nothing is known of the religious tenets of these people. When they are among Mohammedans or Christians, they conform to the religious ceremonies of their creed, visit the mosques, and pray: but they keep closely together, and thus the Druses have succeeded in acquiring a great influence in Syria.

If by the term Nomadic tribes we understand not only people who exclusively live on the produce of their herds and flocks, but also those who cultivate some small spots of ground, and yet principally derive their subsistence from their cattle, and consequently are obliged to change their abode, we may say that there is hardly any tract of considerable extent in Syria without nomadic people on it. This is the effect of the character of the country, in which two districts are generally found contiguous to one another, one of which affords pasture in winter and is barren in summer, while the other yields pasture in summer, and cannot be pastured with advantage in winter. This obliges those who have large herds or flocks to a continual change of abode. But this state of things is very destructive to agriculture under a weak and distracted government like the Turkish of the present day. Nomadic tribes are difficult to keep in order, and they soon inspire the peaceful husbandmen with such a dread of their depredations, that he gladly pays them a tribute on condition of their not laying waste his fields and carrying off his cattle. Burckhardt observes that the tax which the agriculturists of the Haouran pay to the nomadic tribes dispersed among them is much heavier than all the taxes imposed by government and their own chiefs; and this is the reason why so fertile a country, which yields twenty-five fold, is nearly a desert. These hurtful effects are less felt in those parts where the nomadic portion of the inhabitants is not so great; but even on the table-land of Judaea the peasants are generally tributary to the emirs of the nomadic Arabs. There is probably no part of Syria in which this state of things does not exist, except in the country of the Druses, and in the immediate neighbourhood of some great towns, such as Damascus, Aleppo, and Hamah.

There appears to be at present only one tribe of Beduins in Syria who never cultivate the ground, but who live exclusively on the produce of their herds of camels, sheep, and goats. This is the Aeneze, who wander about in the Syrian and Arabian deserts, from 28° to 36° N. lat., and pass the winter there, which lasts from the beginning of October to the end of April, when the rains cause grass and herbs to spring up in many parts of the deserts, on which their flocks feed; but they enter the limits of Syria at the beginning of May, and remain there till after September. At this time they approach the caravan road leading from Aleppo to Damascus, and the Hadji road leading from Damascus to Mecca. They come to these places for a twofold purpose, water and pasture for the summer, and to exchange their cattle for corn as winter provision. If they are at peace with the pasha of Damascus, they encamp quietly among the villages near the springs or wells.

The other Arabian tribes generally cultivate some small part of the district in which they wander about with their herds, and which they consider as their property, obliging the cultivators to pay a heavy tax for permission to cultivate it, and for protection against the individuals belonging to their tribe. The most powerful of these tribes are the El Howeytat and the Beni Neym, who live in the mountain-region of El Shera and in the adjacent plain; the Beni Szakher, who are in possession of the rich pasture-grounds in the Belka, and likewise visit the plain of Haouran; the Adouan, who are found in the Jebel Ajeloun; and the Fehily and Serdie, who move about in the plain of Haouran and the mountains in their vicinity. All these tribes are only nominally dependent on the Turkish governor, and though they pay a small tribute, they levy much larger sums on the agricultural inhabitants of these countries. The other tribes of Arabic origin are not numerous, and they are dispersed over the country as far north as 36° N. lat., where their pasture-grounds are contiguous to those of the Turkmans and the Kurds.

The Turkmans and the Kurds are in almost exclusive possession of the elevated range of the Alma Dagh and the tracts at its base. The eastern districts of these mountains are occupied by the Kurds, and the western by the Turkmans. It is not possible to fix a boundary between them, as in many parts both nations have settled together. They descend from the mountains in winter, and spread over the plains even to a considerable distance south of Aleppo. Some small tribes of both nations, the Turkmans and Kurds, have even settled on the northern districts of Mount Libanus, where they are in contact with the Arabic tribes who pasture in the Bekaa.

The Turkmans are not different from the Turks, and they are the stock from which the Turks sprung. The most powerful tribes of the Turkmans still inhabit those parts where the Turkish empire was formed in the fourteenth century, the elevated table-lands of Anatolia. In the structure of their body, and in their language, there is very little difference between them, except what is the effect of a different mode of life and of a separation of four centuries. Burckhardt was struck with the elegance and regularity of the features in the women of the Turkmans: he considers their complexion as fair as that of European women. That tribe of Turkmans which is settled on the Alma Dagh and in its vicinity is called Ryhanlu. It is not more than forty or fifty years since they applied to agriculture: in the level parts of their country they cultivate wheat, barley, and several kinds of pulse. The cultivation is not carried on by the Turkmans themselves, but by peasants or fellahs, who are either straggling Kurds, or the peasants who belong to some abandoned villages. The Turkmans remain with

their herds in the Umk from the end of September to the middle of April, when they go to the mountains, and by degrees advance as far north as Al Bostan and Gurun and the mountain-ranges in the vicinity of these places, which are more than 100 miles from the parts where they pass the winter. They have horses, camels, sheep and goats, and a few cattle. Their women are very industrious. They make tent-coverings of goats' hair, and woollen carpets, which are inferior only to those of Persian manufacture. They have also made great progress in the art of dyeing. Their colours are very beautiful, and they employ indigo and cochineal, which they purchase at Aleppo. The brilliant [illegible] which they give to the wool is much admired, and [illegible]roduced from some herbs which are gathered in the mountains in summer. The Turkman Ryhanlu pay some attention to the education of their children, but Burckhardt thinks that out of fifty hardly one can read or write. They are not immediately dependent on the Turkish pasha, being tributary to Tshapan Oglu, the powerful proprietor of the eastern part of Anatolia, who resides at Yuzgat, to whom they pay an annual tribute of 6215 piastres in horses, cattle, and other things. The internal affairs of the nation are conducted by a divan, composed of the chiefs of the thirteen minor tribes into which it is divided.

The Kurds who inhabit Syria are evidently a tribe that emigrated long since from Kurdistan to the mountain-range which traverses Western Asia west of the lake of Van, between 38° and 39° N. lat., whence they have gradually spread to the Alma Dagh. At present they are almost exclusively in possession of the western portion of that range, from which they descend in summer to the plains east of Aleppo. There are also some Kurds in the northern districts of Mount Libanus, where however they do not seem to be permanently settled. Burckhardt observes that these Kurds bring annually into Syria from 20,000 to 30,000 sheep from the mountains of Kurdistan, as Syria does not produce a sufficient number of sheep for the consumption of the inhabitants. After visiting the large towns with their flocks, they take to Mount Libanus those which they have been unable to sell, in order to pasture them there until they find an opportunity of selling them in that mountainous district, where few sheep are kept by the Druses and Maronites. The Kurds, who inhabit the Alma Dagh, cannot properly be called a nomadic nation, as most of them live in villages, are stationary, and occupied in agriculture and the rearing of cattle; but there is still a considerable number of families that change their abode according to the seasons, in order to procure pasture for their cattle. The Kurds have a language of their own, which, according to Burckhardt, is a mixture of Persian, Armenian, and Turkish.

Political Divisions and Towns.—Syria is divided into four eyalets, or pashaliks, two of which, Akka and Tarablous, extend over the countries on the shores of the Mediterranean as far north as 35° 55′ N. lat.: the third, Aleppo, occupies the most northern part, from the Mediterranean to the banks of the river Euphrates, and as far south as 35° 45′; and the fourth, Damascus, the interior of the country south of 35° 45′.

1. *The Eyalet of Akka*, better known in Europe by the name of St. Jean d'Acre, to which the eyalet of Gaza was added at the beginning of this century, occupies the whole coast from the boundary-line of Egypt to the Bay of Junie, or Kesrouan (33° 55′ N. lat.), and extends over the plain of Falastin, Mount Carmel, the plain of Ibn Omer, the hilly region of Galilee, the plain of Akka, and the Bekaa and Belad Baalbec. The southern districts of this eyalet are partly sterile and partly of indifferent fertility: the central districts are rather fruitful, and the northern exhibit a considerable degree of fertility, and in many places they are well cultivated. The greater part of the silk and wax exported from Syria is collected in these countries. In Mount Libanus there are rich mines of iron, and in their vicinity coal has lately been discovered. The most remarkable places from south to north are GAZA [vol. xi., 98], a thriving place, containing, according to Dr. Robinson, 15,000 inhabitants.

Jaffa, or Joppe, a town with about 4000 inhabitants, has a harbour, which is so choked up with sand as at present to admit only small boats: the roadstead also is dangerous, the anchorage being too near a ledge of rocks: the town is built on a conical eminence overhanging the sea, and is surrounded on the land side with a wall, in which there are towers at unequal intervals. It has no commerce, but is the common landing-place of the pilgrims who go to Jerusalem, of which place it may be considered the port.

Ramleh, or Ramah, east-south-east of Jaffa, lies in a fertile and well-cultivated plain: it has 15,000 inhabitants, who derive some advantages from the road from Joppe to Jerusalem, which passes through this town.

Kaïsariyeh (Cæsarea) had formerly a harbour, which at present is filled with sand: it was once a large town, as the extensive ruins still prove, but it is now nearly uninhabited.

Tantura has a harbour for small boats, and carries on some commerce with Egypt, from which it receives rice and linens: it exports cattle and fruits.

Kaïfa, or Haïfa, is a small place built on a bay formed by Cape Carmel, but the bay has little depth of water, and admits only boats.

Akka, or St. Jean d'Acre. [ACRE, vol. i., p. 98.]

Tsur, or Sur, the antient Tyrus, is built on an isthmus about 400 feet wide, which is supposed to have been formed by the embankment that Alexander the Great made for the purpose of taking the antient town, the site of which is now uninhabited, and consists of a rock covered with brown earth. The harbour has been filled up with sand, and the roadstead is unsafe, but it is better than that of either Akka or Saïda. The population amounts to 3000 individuals, most of whom gain their livelihood by fishing and agriculture. It exports tobacco, wax, and fire-wood.

Zaïda, or Zeïdeh, the antient Sidon, is built on rising ground which overhangs the sea. The streets in the upper town are narrow and dark, but in the lower part of the town they are wider. Its harbour was filled up by Fakr-ed-Din, in the last century, and at present admits only boats. The roadstead is protected by a ledge of rock, rising about 15 feet above the sea-level, and 500 feet long, at the end of which is a small fortress. It has safe anchorage during the prevailing south-western winds, but it is exposed to the northern gales. The town has between 7000 and 8000 inhabitants, and several dyeing-houses: large quantities of silk are exported.

Beïrut. [BEIRUT.]

Junie is a small town with a landing-place for small boats: it carries on some commerce with the island of Cyprus.

In the interior are the following towns:—

Nazareth, or, as it is now called by the natives, Nazsrah, is built in a beautiful valley which opens into the plain of Ibn Omer, and is in one of the most fertile and best cultivated districts of Galilee. It has about 2000 inhabitants, and a fine church.

Tabarieh, the antient Tiberias, is on the banks of the Bahr el Tabarieh, on a small plain, surrounded by mountains. Towards the land it is enclosed by a thick and well-built wall. It contains about 4000 inhabitants, who have some commerce with the Beduins of the Ghaur, and of the country north-west of the town. It is a place of pilgrimage for the Jews, who constitute about one-third of the population: the remainder of the population are Turks, with the exception of a few Christians. This place was nearly levelled to the ground by the earthquake of 1837.

Szafed, nearly due north of Tabarieh, is a neatly-built town, situated round a hill, on the top of which is a Saracenic castle. It contains 600 houses, of which about 150 are inhabited by Jews, who consider this one of their holy cities, and about 100 houses by Christians. In the neighbourhood there are large plantations of olives and vineyards. There are some manufactures of cotton cloth, and dyeing-houses. The population is between 6000 and 7000. This place also was almost destroyed by the earthquake of 1837.

Zahle is in a narrow valley, at the eastern base of Mount Libanus, which opens into the Bekaa. It contains from 800 to 900 houses, and is almost exclusively inhabited by Christians, who make much cotton cloth and some woollen stuffs. They have 20 dyeing-houses, and a considerable trade with the Beduins of the Bekaa.

Baalbec. [BAALBEC, vol. iii., p. 221.]

Deir el Kamr, the capital of the emir of the Druses, south-east of Beirut, in a valley of Mount Libanus, is a considerable place. [DRUSES, vol. ix., p. 160.]

2. The *Eyalet of Tarablous*, the smallest of the political sections of Syria, extends along the sea-coast from the Bay of Junie to Cape Possidi, about 12 miles south of the mouth of the river Aazy, and comprehends the northern and more elevated portion of Mount Libanus, the plain separating

mountain from the Jebel Anzeyry, and the largest portion of the last-mentioned range. The whole of it, with the exception of the plain, is fertile and well cultivated. It produces silk, tobacco, oil, fruits, galls, and wax, for exportation. The inhabitants are Turkmans, Kurds, Anzeyris, and Ismanlis: the two last-mentioned tribes are only found in the Jebel Anzeyry, where the emir of the Anzeyris lives in the small town and castle of Szafitta. The following are the chief places in this eyalet, from south to north.

Meinet Berdja, a small harbour, and a still smaller town, which has some commerce with Cyprus, and receives from that island wheat and salt.

Jebail, the antient Byblus, is a small town, enclosed by a wall. It has a small harbour, and carries on some commerce with Cyprus.

Batroun, the antient Bostrys, is a town consisting of from 300 to 400 houses, mostly inhabited by Maronites. There is no harbour, but an artificial inlet has been formed in the rocks, which admits a few coasting boats. It has no commerce: excellent tobacco is grown along the shores of the Mediterranean.

Tarablous, the antient Tripolis, called by the Arabs Tarâbolos, one of the most commercial places of Syria, is built on the declivity of the lowest hills of Mount Libanus, and is divided by a river, called Nahr Kadish, into two parts, of which the southern is the more considerable. The town is well built, and is much embellished by gardens, which are not only attached to the houses in the town, but cover the whole triangular plain between the town and the sea. The town is supplied with excellent water by an aqueduct, which crosses the river upon arches. It has a population of between 15,000 and 18,000 individuals, and some large manufactures of soap for exportation. The harbour is about two miles from the town: it is called El Myna, and is itself a small town, inhabited by sailors and shipwrights. This harbour is formed by a line of low rocks stretching from the western side of Myna about two miles into the sea, towards the north, but it is not safe in northerly winds. In a north-north-west direction from the harbour there is a line of small islands, the farthest of which is about ten miles from the mainland. The exports consist of a large quantity of silk, sponges, soap, and alkali, to Anatolia; galls brought from the Anzeyry mountains, yellow wax from Mount Libanus, madder from Hamah and Hems, scammony and tobacco. The tobacco goes to Egypt.

Jebili is a small town, in the neighbourhood of which much tobacco is grown, which is exported to Latakia. There is a small port.

Latakieh, called by the natives Ladekiye, the antient Laodicea, stands on the northern edge of an elevated tongue of land, called Cape Ziaret, which advances nearly two miles beyond the general line of coast. The houses stand partly in the midst of gardens and plantations, and most of them have flat roofs. The port, called Scala or Marina, is about half a mile from the town, and separated from it by gardens and plantations. The harbour is a small basin, with a narrow entrance: it is however well sheltered, except to the west. It admits only vessels of 100 tons burthen. The chief exports of this place are tobacco of excellent quality, most of which goes to Egypt, cotton, raw silk, and wax. The imports are rice from Egypt, wine from Cyprus, and assorted goods, especially hardware, from England.

In Mount Libanus is Kanobin, a convent, the seat of the patriarch of the Maronites. In its vicinity are the famous cedars of Mount Libanus. About a mile and a half from the coast is the island of Ruad, on which the antient town of Aradus was built: it is at present nearly uninhabited.

3. The *Eyalet of Haleb*, or *Aleppo*, contains the northern part of the Jebel Anzeyry, the valley of the lower Aazy, together with the Ghab, the Jebel Amar, the Umk, the Hilly Region of Northern Syria, and the Northern Plain. The western and northern portion is very fertile, and in many places is well cultivated; the eastern is partly stony, and partly sandy, and for the most part a desert. The salt lake El Sabkh is in the plain. The Beduins are only found in the eastern and southern districts; near the range of the Alma Dagh, and within the range are the Turkmans and Kurds.

On the coast are the harbours of Scanderoon, or Iskenderun [SCANDEROON, vol. xxi., p. 1], and of Sweïdiyah. The latter is not far from the mouth of the river Aazy, and has good anchorage, but it is much exposed to western and south-western winds. Near it there is a large and scattered village of the same name.

In the valley of the river Aazy is Antakia, or Antiochia [ANTIOCHEIA, vol. ii., p. 108], and in the plain is the capital of the eyalet of Aleppo, or Haleb. [HALEB, vol. xii., p. 12.]

To the south-west of Haleb, and near the base of the Hilly Region, is the town of Edlip, containing more than 1000 houses, some manufactures of cotton stuffs, a few dyeing-houses, and a large manufacture of soap. It has a considerable trade with the fertile and well-cultivated district in which it is situated, which it provides with rice, coffee, oil, tobacco, and manufactured goods.

Aintab is a large town, situated at the base of Alma the Dagh. [AIN-TAB.]

4. The *Eyalet of Damascus*, or *Sham*, extends over the southern of the two great plains which occupy the north-eastern portion of Syria, over the plains of Damascus, the southern portion of Mount Antilibanus, the greater part of the Wadys Seissaban and El Ghaur, the table-land of Judæa, the Haouran, and the mountain-regions of the Belka and the Shera. Its productions, though very various, do not supply articles of export, with the exception of alkali, galls, and bitumen; but this eyalet supplies the numerous manufactures of Damascus with most of the materials which are used in them. There are Beduin Arabs in every district, but no other nomadic tribe.

On the table-land of Judæa is Jerusalem, called by the Arabs 'Kods el Sherif' (the sanctuary of the just) [JERUSALEM, vol. xiii., p. 108], Nablous, and Khalil. Nablous, the Sichem of the Bible, and the Flavia Neapolis of the Romans, is a town of considerable extent, and well built. It is situated in a valley, which is covered with plantations of fruit-trees, and is a thriving place. Khalil, the Hebron of the Bible, and one of the holy cities of the Jews, is south of Jerusalem, not far from the place where the table-land of Judæa joins the Desert of El Tyh. It contains about 3000 inhabitants, and has some glass-houses.

On the banks of the river Aazy are the towns of Hamah and Hems. Hamah, the antient Epiphania, lies on both sides of the river, and is partly built on the declivity of a hill and partly on a plain. It contains between 30,000 and 40,000 inhabitants, among whom are many rich Turkish families. Though the houses make no great show, they are well arranged and furnished. It is one of the principal places to which the Arabs resort to buy tent furniture and clothes, and it has several manufactures: the abbas, or woollen cloaks, made here are much prized. There are four bridges over the river. Hems, the antient Emesa, contains a population of between 25,000 and 30,000 individuals, and several manufactures. It is not so well built as Hamah. To the south-east of this town, at the distance of nearly 100 miles, are the ruins of Palmyra, or Tadmor. [PALMYRA, vol. xvii., p. 175.]

In the valley of the Upper Jordan, or Seissaban, are Hasbeya, Rasheyat-el-Fukhar, and BANIAS (vol. iii., p. 374). Hasbeya is built on the top of a mountain, and is a thriving place, with 700 houses, and manufactures of cotton-cloth for shirts and gowns, and a few dyeing-houses. In the vicinity are traces of quicksilver, iron-ore, and upwards of twenty-five pits, from which the Bitumen Judaicum is obtained, which is an article of trade, and sent to Aleppo, Damascus, and Beirout. Rasheyat-el-Fukhar, farther south, is only a village on the top of a mountain: it contains about 100 houses, each of which may be considered as a manufactory of earthen pots. They are moulded in very elegant shapes, painted with red earth, and form a considerable article of inland trade, especially in the eastern districts of Syria.

In the Plains of Damascus there is only Damascus, or Sham. [DAMASCUS, vol. viii., 296.]

In the mountain-regions east of the Jordan are the towns of Szalt, Kerek, Tafyle, and Maan. Szalt, which is nearly in the centre of the Belka Mountains, is situated on the declivity of a hill. It constitutes a republic, independent of the Turkish pashas, who have made several attempts to subject it, but without success. The population consists of about 400 Mussulman and 80 Christian families of the Greek church, who live in perfect amity together. The greater part of the population is agricultural; a few are weavers; and there are about twenty shops, which furnish the Beduins who inhabit this region with articles of dress and furniture. Much sumach, which is collected in the mountains, is sent to Jerusalem for the use of the tanneries; and ostrich feathers are taken by the Beduins to

Damascus. In its neighbourhood are the ruins of Amman, or Philadelphia. Kerek lies in the northern district of the Shera Mountains, and is built on the top of a steep hill, which is surrounded by a deep and narrow valley. It is inhabited by 400 Mussulman and 150 Christian families, who live on a footing of equality, are independent of the government, and masters of that part of the mountain-region, which is inhabited by a tribe of Beduins who are dependent on the chief or sheik of the town, who however has a very limited authority within the place itself. It appears however that during the Egyptian administration, Szalt, as well as Kerek, has been again subjected to a strict obedience to government. The population is agricultural, and sends sheep, goats, mules, hides, wool, and madder to Jerusalem, and provisions to the Hadji road, which is about 15 miles east of the town. Tafyle is in the centre of the Shera Mountains, on the declivity of a hill, in a country abounding in springs and rivulets, and full of plantations of fruit-trees. Figs, wool, butter, and hides are sent to Gaza. The town contains about 600 houses, but suffers much from the exactions of the Howeitat Beduins, the authority of the Turkish government being very small. The town of Maan stands on two small hills on the desert table-land which is east of the mountains of Shera. It consists of about 100 houses on both sides of the Hadji-route, which divides the town. There are several springs, by means of which the extensive plantations of figs, pomegranates, apricots, peaches, and plums are watered. No corn is grown in these parts. The town owes its existence to the Hadji-road, and derives considerable profit from the pilgrims by selling them provisions brought from other parts, especially from Khalil and Gaza. West of Maan, in the Wady Musa, near the great Wady El Arabah, are the ruins of PETRA (vol. xviii., p. 35).

Manufactures.—Syria is the most manufacturing country in Western Asia. With the exception of hardware and cutlery, there is hardly any manufactured article imported into Syria: but a great variety of goods which are made in Syria are exported to Egypt and Anatolia, and still greater quantities go to the countries farther east, and find their way into Persia, where they meet the articles brought from Hindustan. The most manufacturing town is Damascus. The manufacturing industry of this place is of great antiquity, for it is mentioned by the prophet Ezekiel (chap. xxvii., 16 and 18), at a time when probably no manufactures existed in any part of Europe.

We may even conjecture with some degree of probability that the extensive commerce which the Phœnicians carried on in antient times was founded rather on the manufactures of Damascus than on their connection with India, or any other country of Asia. The Phœnicians were probably supplied from Damascus with a great number of manufactured articles for the market of the countries that surround the Mediterranean, and they supplied the manufactures of Damascus with some of the materials used in them. The extent of the manufacturing industry of this town may be conceived from the statement of Schubert, that above 40,000 persons are employed in making silk stuffs, especially satin and silk damasks and brocades; and that caravans frequently go from Damascus to Haleb, which take no other goods but articles of this description. A considerable number of persons are also engaged in the manufacture of cottons and linens, and there are numerous tanneries. The manufacture of saddles and horse and camel trappings is also important: these articles are sent to a great distance, being highly prized all over the East. The workmen in jewellery and gold and silver show both taste and skill. Many others work in copper and iron; and though the sword-blades of Damascus have not at present that reputation which they formerly had, this seems more the effect of the improvements in the manufacture of swords in other places, than of a deterioration in the manufactures of Damascus. There are several extensive tobacco-manufactures and soap-houses; and also a great number of workmen, in ivory and precious woods. The number of persons who make perfumes, balms, aromatic oil, sweet-scenting essences, &c., of which the inhabitants of the East are very fond, is much larger than in any of the manufacturing towns of Europe.

From the account of Schubert it appears that there is a branch of manufacturing industry at Damascus, which is hardly known in Europe, that of ready-made dishes, of cakes, and all kinds of confectionary and pastry, which are sent to remote places, and even find a sale among the Beduin Arabs. This account is confirmed by Poujoulat, who stated that there are more than 400 cooks in Damascus. Poujoulat has given a list of the principal branches of manufacturing industry in Damascus. [DAMASCUS, vol. viii., p. 296.]

The manufactures of Haleb are small compared with those of Damascus, and mostly limited to cotton and silk stuffs, and gold and silver lace. It must also be observed that some branches of manufacturing industry are carried on in most of the small towns, and even in some villages, such as cotton stuffs for gowns and shirts, the dyeing of cotton, mostly blue and red, tanning leather, and making soap. Such places however supply only the neighbourhood, and the Beduins who resort to them for such articles, and they rarely if ever work for a distant market.

Commerce.—The commercial intercourse between Syria and Europe is very small. None of the agricultural products of Europe are in demand in Syria; no kind of grain is imported, with the exception of rice, with which Syria is supplied from Egypt. The manufactured goods of Europe are not in demand, not being adapted to the taste and customs of the East. The only article which is imported to a certain extent is hardware, which is almost exclusively supplied by England: some French cloth is also imported. The chief articles sent from Europe to Syria are supplied by the East and West Indies, and consist of indigo, cochineal, and coffee. The consumption of coffee from the West Indies has increased considerably in Western Asia since the beginning of the present century. Very little sugar is imported: the debs, an extract from grapes, is used as a substitute for it in most parts of Western Asia; and this article is made in Syria to a great extent, and of the best quality: it is also exported to the other parts of the Turkish empire in Asia and to Egypt. The most important article of export to Europe is silk, which probably amounts to 2000 bales of 200 lbs. each; a fact which shows to what extent this branch of industry is carried in Syria, when it is considered that probably a much greater quantity is consumed in the manufactures of Damascus and Aleppo. Other less important articles are galls, olive-oil, sponges, fruits, and tobacco. The fruits, which are principally exported, are dates, raisins, figs, and pistachia-nuts. Madder is also exported to a moderate extent. There is some maritime intercourse between Syria on one side, and Egypt, Cyprus, and the coast of Caramania on the other. It is carried on by small coasting-vessels, which are best adapted to the shallow and narrow harbours of the Syrian coast, and is limited to the exchange of some agricultural products, and to the exportation of soap and some cotton stuffs. Egypt receives chiefly live stock and tobacco, for which it pays with rice.

The commerce between Syria and the countries to the east and north of it is very extensive, but we have no information by which we can form an estimate of its amount. We only know that at all seasons of the year numerous caravans are on the road going or returning from these parts. This commerce is concentrated in Aleppo, as the desert which lies between the town of Damascus and that of Hit on the Euphrates is almost impassable, and is also in the possession of the powerful tribe of the Aeneze Beduins, so that a caravan rarely passes directly from Damascus to Hit by the way of the ruins of Palmyra. It may be said that this route is almost entirely abandoned, and the manufactured goods go from Damascus to Aleppo, whence they are carried to Anatolia and Constantinople, and to Mosul, Bagdad, and Basra. Two well-frequented roads lead from Aleppo to Constantinople through Anatolia. The most western leads from Aleppo westwards to Antiochia (Antaki), and thence through the Baïlan Pass to Scanderoon, whence it runs along the shores of the Bay of Scanderoon to Adana. From this place it ascends the elevated table-land of Anatolia, and passing through Koniyeh, Afiyum Kara-Hissar, and Kutahiyah, reaches the Sea of Marmora at Ismid. The eastern commercial road runs due north from Aleppo, and traverses the chain of the Alma Dagh between Aïntab and Al Bostán, where it proceeds to Kaïsariyeh. At the last-named place the road divides; one branch, running north-east, leads to Sivas, Tokat, and Amasieh, and the other continues in a north-east direction to Angora, and thence to Ismid and Constantinople. Two roads lead from Aleppo to Persia, which divide at Orfa in Mesopotamia. From Aleppo the road runs north-east to Bir, where the Euphrates is crossed, and from which place to Orfa it continues westward. The northern road leads from Orfa to Diarbekr, where it passes

the Tigris, and thence goes over a very mountainous district to Bedlis and Van, and from Van it continues to Tabriz. The southern road crosses the whole width of Mesopotamia, beginning at Orfa, and passing through Mardin, Nisibin, and Mosul, where it crosses the Tigris, and whence it continues through Kirkuk, Kirmanshah and Hamadan to Teheran. This road is also sometimes used by the Bagdad caravans, which then proceed from Mosul through Samarah to Bagdad. But the most frequented caravan-road between Aleppo and Bagdad lies to the west of the Euphrates, passing from Aleppo in a south-eastern direction through the northern and less desert part of the Syrian Desert, which it enters after leaving the El Sabkh, or Salt Sea. It reaches the banks of the Euphrates at Annah, and runs along it to Hit, where it crosses the river and then goes due east to Bagdad, or continues south-east by Hilla to Basra.

It has been said that no account has been given by any traveller of the country between 33° and 33° 20′ N. lat. on the west of the Southern Valley. But Dr. Robinson has lately traversed this country obliquely in his journey from Safed to Sur, and he says that this tract is distinguished by peculiar features. After having crossed three valleys, he entered a wide plain by a considerable ascent. Volcanic rocks were dispersed over it, and they increased in number as he proceeded north-west, until they covered the whole surface of the ground. In the midst of this plain was a depression, which was evidently the crater of a volcano, and the lowest part of it was occupied by a lake. The whole tract was entirely barren. From this high ground he descended into another basin-like plain of smaller extent, which was cultivated and surrounded by bushy hills, and separated by a valley from a high undulating table-land, the soil of which was fertile and cultivated, and which was enclosed by swelling hills covered with shrubs and trees. So far the country was drained by water running to the Bahr el Houle. He then passed over higher ground, interspersed with hills, but otherwise presenting an almost level tract on the top, which formed the water-shed between the Bahr el Houle and the Mediterranean. It was covered with small oak-trees. The remainder of the country presented a succession of wooded hills and valleys, of which the cultivated portion was small, the whole being employed as pasture for cattle, which are so numerous, that butter is used instead of oil, which is the case in no other part of Palestine. The hills are much more thickly wooded than in any other part of Southern Syria west of the Great Valley, and fire-wood is a considerable article of export from Sur, to which it is brought from this country. In approaching Sur, Dr. Robinson passed through an extensive undulating region, which was well cultivated, and he then descended from the higher ground, which, according to his estimate, was from 1200 to 1500 feet above the sea-level towards the shore, to a country which consists of numerous ridges and of valleys opening towards the Mediterranean, in which there are woods of prickly oak, maple, arbutus, and sumach, and in which the plantations of tobacco were extensive. Their produce is exported from Sur.

(Russell's *Natural History of Aleppo;* Pococke's *Description of the East;* Volney's *Voyage en Syrie et en Egypte;* Burckhardt's *Travels in Syria and the Holy Land;* Browne's *Travels in Africa, Egypt, and Syria;* Buckingham's *Travels in Palestine through the Countries of Bashan, &c.;* Schubert's *Reise in das Morgenland;* S Robinson's *Travels in Palestine and Syria;* Burckhardt Barker's *Notes made on a Journey to the Source of the river Orontes,* in *London. Geogr. Journal,* vol. vii.; Ainsworth's *Notes upon the Comparative Geography of the Cilician and Syrian Gates,* in *London Geogr. Journal,* vol. viii.; Chesney, *On the Bay of Antioch,* in *London Geogr. Journal,* vol. viii.; Count Bertou's *Journey to Akabah,* and E. Robinson's *Travels in Palestine, &c.,* in *London Geogr. Journal,* vol. ix.; Medem and Parthey, Notes in Berghaus's *Geographische Memoir zur Erklärung und Erläuterung der Karte von Syrien;* Count Forbin's *Travels in Greece, Turkey, and the Holy Land;* E. Robinson's and E. Smith's *Biblical Researches in Palestine, Mount Sinai, &c.;* and *A General Statement of the Labours and Proceedings of the Expedition to the Euphrates,* in *London Geogr. Journ.,* vol. vii.)

SYRIA (ἡ Συρία) was the Greek and Roman name for that country of Asia which forms the whole or a part of the district called in the Bible ARAM (אֲרָם), the Arabian name of which is Sham, and the European, Syria. The etymology of the name is very uncertain: the only derivations worth mentioning are two, the first of which is from Sur, an antient name (and also the modern name) of Tyre; the other makes it a shortened form of Assyria (Major Rennell supposes Syria to be Assyria without the article),—a supposition somewhat supported by the fact that the two names are often confounded or used indifferently by the antient writers. (Herod., vii. 63.) In fact, of the various senses in which the word is used, one makes it include nearly the whole of Assyria, that is, all that country except Mesopotamia. In this, its widest extent, Syria included all the country to the west of the Euphrates, as far south as Egypt and Arabia, while on the north and west it embraced the greater part of Cilicia, Cappadocia, and Pontus, its boundaries on this side being the river Halys and the Euxine Sea. (Herod., i. 72; v. 49; Strabo, xvi., p. 737; Rennell's *Geog. to Herod.,* i., pp. 254, 347.) Pliny (v. 13) and Mela (xi. 1) carry its boundaries still farther to the east and north, and make it include Mesopotamia and Armenia. It appears indeed that all the tribes of the great Aramaean family were called Syrians, in the widest and most antient sense of the word.

In the most usual application of the word, Syria was the district bounded by the range of Amanus on the north, by the Mediterranean on the west, by the Euphrates and the Arabian Desert on the east and south, and by the 'river of Egypt' (probably the river El-Arish) on the south-west. In a still narrower sense it sometimes denoted the same district, with the exception of Phœnicia and Palestine. (Ptol., v. 16.) Herodotus, in speaking of Palestine, includes it in Syria, as a subordinate division: he calls it 'the Palestine Syria' (ἡ Παλαιστίνη Συρίη, ii. 106).

The Syrians (not including the inhabitants of Phœnicia and Palestine under the name) derived their descent from Aram, the youngest son of Seth (*Gen.,* x. 22).

History of Syria to the death of Alexander the Great.—The earliest records of the state of Syria represent it as consisting of a number of independent kingdoms, of which the following are mentioned in the Bible:—(1.) Aram of Damascus (אֲרַם דַּמֶּשֶׂק, 2 *Sam.,* viii. 6; *Isaiah,* vii. 8; xvii. 3; *Amos,* i. 5) was always the most powerful city, and in some sense the capital of the country. Its kings were frequently engaged in war with the Jews. (2.) Maacah (מַעֲכָה), in the neighbourhood of Bashan, had a king in the time of David (2 *Sam.,* x. 6). (3.) Geshur (גְשׁוּר), in the neighbourhood of Maacah (2 *Sam.,* iii. 3; xiii. 37; xv. 8), had still a king in the time of Solomon. (4.) Aram of Beth Rechob (אֲרַם בֵּית רְחוֹב, 2 *Sam.,* x. 6) was a district at the foot of Anti-Libanus, named after the town of Rechob, in the neighbourhood of the town of Dan, or Laish, in the north of Palestine. (5.) Near this was Chul (חוּל, *Gen.,* x. 23). Besides these, the towns of Hamath, Helbon, Riblah, Tadmor, Bethoden, Berothai, Mash, and others, had probably their own princes.

The conquests of David (B.C. 1055, &c.) brought these states into subjection to the kingdom of Israel; but they again became independent at the close of Solomon's reign (B.C. 975). From this time the kingdom of Damascus especially is frequently mentioned in connection with the history of the Israelites, and it appears gradually to have grown in power, and to have held supremacy over the other states of Syria (1 *Kings,* xx. 1), and even to have given the kings of Israel great trouble, till the reign of Joash (B.C. 845), who obtained considerable successes against Benhadad (2 *Kings,* xiii. 22-25). The last king of Damascus was Rezin, who having engaged with Pekin, king of Israel, in war against Ahaz, king of Judah, Ahaz invited Tiglath-Pileser, king of Assyria, to attack Damascus, which he took, and carried the inhabitants captive to Kir (2 *Kings,* xvi. 1-9) about the year 740 B.C. (Clinton's *Fasti Hellenici,* i. p. 273-4.)

From this time Syria formed a part of the Assyrian, Babylonian, Persian, and Macedonian empires in succession, but during this whole period, down to the death of Alexander the Great (B.C. 323), its history presents nothing worthy of notice.

Syria under the Seleucidæ, down to its subjection to Rome.—The wars between the generals of Alexander for the possession of western Asia are narrated in the articles ANTIGONUS, EUMENES, PERDICCAS, and SELEUCIDÆ. After the battle of Ipsus (B.C. 301), Syria, with the exception at first of Cœle-Syria and Palestine, fell to the share of Seleucus

Nicator, and henceforth it became the central portion of the kingdom of the Seleucidæ, the usual abode of the kings being at its capital, Antioch. A list of the kings of this dynasty is given in the article SELEUCIDÆ, and the history of their reigns under their respective names. For the relations of Palestine and Syria during this period, see JEWS, MACCABEES, ASMONÆANS. The empire of the Seleucidæ was destroyed, and Syria was declared a Roman province by Pompey, in the year 65 B.C. The small district of Commagene was left for a time under its own princes. [COMMAGENE.] During the civil wars of Rome, Syria suffered much from the conflicts of the two parties, the power of native robbers, and the incursions of the Parthians, and it was not till the reign of Augustus that it became quietly settled as a part of the Roman empire. It was governed by a proconsul, who commonly resided at Antioch. In the year 6 A.D., upon the banishment of Archelaus, Judæa and Samaria were added to the province of Syria, to which they henceforth belonged, with a short interruption during the reign of Herod Agrippa I.

Antient Divisions of Syria.—Under the Macedonian kings, Syria was divided into four parts (tetrarchies), which were named after their capitals, Antioch, Seleuceia, Apamea, and Laodicea. Both the Greeks and the Romans called the northern portion of Syria, that is, the whole country with the exception of Coele-Syria, Phoenice, and Palestine, by the name of Upper Syria (ἡ ἄνω Συρία, Syria Superior), to distinguish it from Coele-Syria (ἡ κοίλη Συρία, that is, the Hollow Syria), which was the name given to the valley between the ridges of Libanus and Anti-Libanus. Under the Romans the province was divided into nine districts: Cassiotis, Apamene, Chalcidice, Seleucis, Pieria, Commagene, Cyrrhestice, Chalybonitis, Palmyrene. The following were the chief towns:—1, In Cassiotis, which lay along the coast, between Mounts Casius and Libanus, and touched Phoenice on the south; Gabala (Jebili), a sea-port; farther north, Laodicea (Latakieh), formerly called Ramitha, and afterwards Leuce Acte; Posidion (Posseda, or Ras Bosyt). 2, In Apamene, which lay east of Phoenice and Cassiotis, along the course of the Orontes: Emesa (Hems), near a lake formed by the Orontes, celebrated for its temple to Elagabalus, or the sun, whose priest became emperor of Rome [ELAGABALUS], for the defeat of Zenobia, by Aurelian, and for its defence against the Arabians (A.D. 635); Arethusa (Rostan); Epiphania, the Hamath of the Bible and the present Hamah; Apamea, formerly Pella, and now Kalaat el Medyk; Seleuceia on the Belus (Schjure?); ANTIOCH. 3, In Chalcidice, which lay east of the Orontes, towards the desert; Chalcis, the ruins of which still exist near Kinesrin. 4, In Seleucis, north of the mouth of the Orontes: Seleuceia, on the sea, the ruins of which are at Souvadia, or Sweïdiyah. 5, In Pieria, which lay on the Issicus Sinus (Bay of Scanderoon), and reached on the north to the Syriae Pylae, the pass which divides Syria from Cilicia: Alexandria (Scanderoon). 6, In Commagene, which occupied the northernmost corner of the country between Mounts Amanus and the Euphrates: Samosata (Samaisat) on the Euphrates, the birth-place of Lucian, and of Paul the heretic; Adata, afterwards called Germanicea, and in Latin, Germanica Caesarea, in honour of the emperor Caligula, at a later period Telesaura, and now Chadach, or Marah; Doliche (Dolicha); Antioch at the Taurus, perhaps Bahasna). 7, In Cyrrhestice, which extended from the plain of Antioch eastward to the Euphrates: Zeugma, where there was a passage over the Euphrates, opposite to Birtha (Bir); Arudis, at the mouth of the Marsyas; Hierapolis, formerly Mabog, which name the Greeks turned into Bambyce (βαμβυκη), now in ruins at Mambej, one of the most important cities of Syria, and famous for a temple of Astarte; Beroea, formerly Chaleb, and now Haleb, or Aleppo, the most important town of modern Syria [HALEB]; Gindarus (Gundjarch), a mountain fortress, where Ventidius defeated the Parthians. 8, In Chalybonitis, which was antiently a fertile strip of country on the west bank of the Euphrates, between the river and the desert, but is now swallowed up by the desert, the sands of which cover the ruins of its cities: Thapsacus, the Tiphsach of the Bible, afterwards Amphipolis, and now the little town of Der, on the Euphrates; somewhat higher up the river was Zenobia (Zelebi), which some geographers identify with Thapsacus. 9, In Palmyrene, the south-eastern portion of the country, which, like Chalybonitis, was once partially irrigated and cultivated, but is now a part of the desert: Palmyra, the Tadmor of the Bible, built by Solomon, according to Josephus, the splendid ruins of which still exist near the little village of Tadmor. These ruins, which belong to the period of the Roman empire, are described under PALMYRA; PHOENICE and PALESTINE are described in separate articles.

Diocletian extended the boundaries of Coele-Syria, and added it to Phoenice, under the name of Phoenicia Libanensis. Constantine the Great erected Commagene and Chalybonitis into a new province under the name of Euphratensis, and Theodosius II. divided the remainder of Syria into Prima and Secunda. Antioch was the capital of the former, and Apamea of the latter.

History of Syria under the later Roman Emperors.—Under the Cæsars Syria was one of the most populous, flourishing, and luxurious provinces of the empire. It had a considerable commerce, and formed indeed the emporium which connected the Eastern and Western quarters of the world. Hadrian, upon his accession (117 A.D.), fixed the eastern boundary of the empire at the Euphrates, and henceforth the frontier province of Syria was exposed to repeated inroads, first from the Parthians and afterwards from the Persians. The province was overrun, and almost subdued by Sapor (A.D. 258), from whom it was rescued by Odenathus (261-264), whose elevation to a share in the empire by Gallienus, his death, the attempt of his widow Zenobia to establish an independent sovereignty in the Eastern part of the empire, and her defeat by Aurelian (273 A.D.), are related under PALMYRA.

At the end of the third century, and in the fourth, the Saracens, or inhabitants of the Arabian deserts, who were destined to wrest this valuable province from the empire, began to make their appearance, sometimes in the legions, but more often among the enemies of Rome. But before falling under their arms, Syria once more felt the power of the Persians. In the reign of Phocas, Chosroes II., after reducing Mesopotamia and the neighbouring states, crossed the Euphrates, reduced Hierapolis, Chalcis, and Beroea, and finally Antioch, which he almost completely destroyed (A.D. 611). Heraclius, who had obtained the empire in 610, took the field in 622 against Chosroes, who had in the meantime conquered not only Syria, but also Palestine (614), and had overrun Egypt and Asia Minor (616). In a series of brilliant campaigns Heraclius repeatedly defeated Chosroes, and at last drove him beyond the Tigris (A.D. 627), and Siroes, his son (and by the murder of his father, his successor), made a treaty of peace with Heraclius (A.D. 628), one of the conditions of which was the restoration of the 'true cross,' which had been carried into Persia after the sacking of Jerusalem in 614. But this brilliant recovery of the Eastern provinces was only the prelude to their final loss under the same emperor.

Conquest of Syria by the Saracens.—The history of this period is related by Gibbon, in the 51st chapter of his *Decline and Fall.* His account should be compared with the notes in Milman's edition of that work, and especially with Price's *Chronological Retrospect of Mohammedan History.* Mohammed himself had taken a few towns of Syria (630 A.D.), and his successor, Abu Bekr, had scarcely mounted the throne when he sent a circular letter to the Arabian tribes, calling them to the invasion of Syria (A.D. 632). A large army of Saracens assembled at Medina, whence they marched into Syria under the nominal command of Abu Obeydah, but virtually led by the fierce Khaled, 'the sword of Allah.' They first attacked Bosra, on the east of the Jordan, which was betrayed by the governor Romanus. They then laid siege to Damascus (A.D. 633). The defence was obstinate, and in the meantime Heraclius had assembled an army of 70,000 men at Emesa, under the command of his general, Vardan. The armies met at Aiznadin, the Greeks were utterly routed, and the Arabs returned to the siege of Damascus, which fell, after an obstinate resistance, in 634 A.D., about July or August. After some irregular exploits, which served to show the undaunted valour and fanaticism of Khaled, and to strike terror into the Syrians, the conquest of the country was carried on by the reduction first of Heliopolis and Emesa, and then of other important towns. In the meanwhile Heraclius had prepared for a last effort in defence of Syria. An army of 80,000 men brought from the different provinces of the empire, with a light-armed force of 60,000 Christian Arabs, encountered the Mohammedans on the banks of the river Yermuk; but few Christians escaped from the field of battle (A.D. 634). Henceforward the conquest proceeded with little opposition. The sacred character of Jerusalem procured for it an

honourable capitulation, which the caliph Omar himself came from Medina to receive (637 A.D.). Aleppo submitted, but the castle offered an obstinate resistance, and was taken by surprise, and Antioch purchased its safety at the expense of obedience and 300,000 pieces of gold (A.D. 638). In the same year Heraclius fled from Antioch to Constantinople, and after a show of resistance at Caesarea by Constantine, his eldest son, the province was abandoned to the Saracens, to whom the remaining cities at once submitted. (Compare the article OMAR.)

Syria under the Khalifs.—Under the Ummeyahs, or Ommaiades, the seat of government was at Damascus, whither it was removed from Kufa by Moawiya, who reigned from 656 to 679, but it lost this distinction in 749, when the Abbassides took up their residence at Bagdad.

For more than nine centuries the history of Syria has been to a great extent included under that of Egypt. [EGYPT.] It was subjected with the latter country to the Turkish usurper Ahmed Ebn e' Tooloon, who founded the dynasty of the Tooloonides, which lasted from 868 to 906 A.D., when the Khalif Moktafee recovered both countries; and afterwards to another Turkish usurper, Akhshed Mohammed Ebn Tughg (A.D. 936), whose dynasty lasted till 970; when Moez, a successor of Mahdee, conquered Egypt, and soon afterwards Syria, as far as Damascus, and founded the dynasty of the Fatimite caliphs, whose capital was at Cairo. [FATIMIDES.] In 1076 the Turks invaded Syria and Palestine, took Damascus and Jerusalem, and established an independent kingdom under the princes of the house of Ortok. The Caliph Mostali retook Jerusalem in 1096, but lost it again, with a large portion of Syria, in the first crusade, at the close of which the Christian kingdom of Jerusalem was established, which included the antient Palestine and a tract of country round Antioch. This kingdom lasted from 1099, the year in which the crusaders took Jerusalem, to 1187, when Salah-ed-Deen (Saladin) recovered it. [CRUSADES; SALAH-ED-DEEN.] His dynasty, the Eyoobites, lasted till 1250, when it was destroyed in Egypt and Damascus by the revolt of the Baharite Memlooks. Seif-ed-Deen, the sultan of Aleppo, great-grandson of Salah-ed-Deen, recovered Damascus, but he was overthrown and slain in an invasion of the Moguls from Persia in 1260. For the history of European connection with Syria in the twelfth and thirteenth centuries, see CRUSADES.

Syria continued subject first to the Baharite and then to the Circassian Memlooks till the overthrow of the latter by the Turks in 1516-17. [MAMELUKES.] Their possession of the country was however interrupted for a short time by TIMUR, or Tamerlane, who invaded Syria and sacked Aleppo in 1400, and in the next year destroyed Damascus. He did not however attempt to keep possession of the country.

Syria under the Turks.—In the year 1516 Syria was conquered and united to the Ottoman empire by the Sultan Selim I. It is still under the power of the Porte

In the later history of Syria there is nothing worthy of notice till its invasion by Napoleon, A.D. 1799. [BONAPARTE, vol. v., p. 124-5.]

In the year 1831, Mehemet Ali, the present viceroy of Egypt, having formed the design of erecting Egypt and Syria into an independent kingdom, took up arms against the Porte on the pretext of a dispute with the pasha of Damascus. His son, Ibrahim Pasha, invaded Syria, and took Gaza in October, and on the 9th of December attacked Acre. After in vain issuing a firman, commanding Mehemet to withdraw his forces from Syria, the sultan declared war against him (April 15, 1832). In the mean time Ibrahim, assisted by French and English officers and Greek sailors, and having formed an alliance with the chief of the Druses of Lebanon, took Acre on the 21st of May, and Damascus on the 13th of June. On the 7th of July he defeated the army of the sultan at Hems, took Antioch on the 1st of August, and on the 21st of December utterly routed the forces of the sultan at Koniah in Anatolia, taking the grand vizier prisoner, and then pressed on for Constantinople. In the mean time the sultan claimed the help of Russia. That power prepared to act against Mehemet Ali by sea and land. France and England now exerted themselves to guard against the preponderance of Russian influence, and at length a peace was concluded, and the sultan, by a firman issued on the 6th of May, 1833, confirmed Mehemet in his government of Egypt and Candia, granting to him in addition that of Damascus, Tripoli, Said, Safed, Naplous, and Jerusalem, and on the 9th orders were sent by the viceroy to Ibrahim to repass the Taurus. Mehemet did not however renounce his project, while on the other hand the sultan continued to watch for a favourable opportunity of recalling the concessions extorted from him. After a long series of indecisive movements on both sides, and of fruitless negotiations between the two parties and the great European powers, matters were brought to a crisis by the renewal of hostilities in Syria, in May, 1839, followed by the defeat of the Turkish forces by Ibrahim at Nezib (June 25), and the desertion of the Turkish fleet to Mehemet Ali on the 4th of July. On the 16th Mehemet announced to the new sultan Abd-ul-Medjid his determination to assert by force his claim to the hereditary government of all the provinces under his command, as a reply to the sultan's offer of the hereditary government of Egypt. The five powers of England, France, Austria, Prussia, and Russia, now induced the Porte to take no further steps without their advice. The negotiations which followed ended in the secession of France, and the conclusion of a treaty between the remaining four powers and Turkey, to compel the submission of Mehemet. The treaty was signed in London, on the 15th of July, 1840. In pursuance of this treaty a fleet consisting of English, Austrian, and Turkish vessels, commenced operations on the coast of Syria by the storming of Beyrout about the middle of September. Acre and Sidon shared the same fate shortly afterwards, and after much negotiation, Mehemet consented to give up Syria entirely, and received from the sultan the hereditary government of Egypt (January 11, 1841). Sir C. Napier has just published a history of this war.

The religions of Syria are various. There are Mohammedans, who are of the Shiite sect, Jews, Christians of the Greek, Latin, and Armenian churches [GREEK CHURCH], besides remnants of other antient Christian sects. There are also many European residents, especially of the English and Lutheran churches, to watch over whose interests, and to advance Christianity among the Jews, a bishop of the Anglican church (Dr. Alexander, a converted Jew) has recently been sent out, with the title of bishop of Jerusalem, by the combined efforts of the English and Prussian governments.

SYRIAC LANGUAGE. The Syriac, or Western Aramaic [ARAMAEAN LANGUAGE], is a language of the Semitic family, and was spoken by the inhabitants of Syria and Mesopotamia, and, after the Captivity, in Galilee. It differs very little from the Chaldee, or Eastern Aramaic, the resemblance between the dialects being so close that Chaldee written in Syriac characters, without points, is good Syriac, with the exception of one inflection in the verbs. The two dialects differ chiefly in their systems of vowel points and in the use of a different character.

Under the Seleucidae, the Syriac was, in all public transactions, and to a great extent in common use, supplanted by the Greek, but even to this day it is sometimes heard in Syria. A mixture of the two dialects of the Aramaic formed the common language of Palestine in the time of Christ [ARAMAEAN LANGUAGE], and hence we find in the New Testament many idioms and some words of the Syriac.

The principal, as it is also the most antient work in the Syriac language, is the Peshito, or old Syriac version of the Bible. [SYRIAC VERSION.]

The principal Syriac grammars and lexicons are the following: Schaaf, 'Opus Aramaeum,' 1686; C. B. Michaelis, 'Syriasmus,' 1741; J. D. Michaelis, 'Grammatica Syriaca,' 1784; Jahn, 'Elementa Aramaicae Linguae,' 1820; Yeates' 'Syriac Grammar,' 1821; Dr. F. Nolan, 'Introduction to the Syriac Language,' 1821; by far the best grammar is Hoffmann's 'Grammaticae Syriacae Libri iii.,' 1827: there are lexicons by Trostius, Gutbirius, Schaaf, and Zanolini.

SYRIAC VERSIONS of the Bible. Of these several exist, two of which are of considerable importance. 1. 'The Peshito (*literal*) Version,' also called 'The Old Syriac Version,' is one of the most antient and valuable translations of the Bible. The version of the Old Testament is ascribed by various traditions to the age of Solomon, to the hand of Asa, priest of the Samaritans, and to the Apostle Thaddeus. It is referred to by Ephrem the Syrian, in the middle of the fourth century, as generally known and used, and therefore it must have been in existence a considerable time before. Modern critics have referred its date variously to the first, second, and third centuries, the majority to the first. The opinion now generally adopted is that of Michaelis, who ascribes the translation of both Testaments to

the most flourishing period of the Syrian churches, namely the end of the first and the beginning of the second century.

The version of the Old Testament was certainly made from the Hebrew, which it closely follows; but there are indications of the translator having made use of the Septuagint and of the Chaldee paraphrase. The great antiquity of this version, much higher than that of any existing Hebrew MS. of the Old Testament, makes it a most valuable source of biblical criticism. It is on the whole a very good translation, but not equal throughout. A different method of interpretation is followed in different books, for instance in the Pentateuch and the Chronicles. From this circumstance Jahn infers that it was the work of different persons. The arguments to the Psalms prove that their translator was a Christian.

The version of the New Testament contains the four Gospels, the Acts of the Apostles, the Epistles of Paul (including that to the Hebrews), the First Epistle of John, the First Epistle of Peter, and the Epistle of James. It is undoubtedly one of the best versions of the New Testament in any language, and is used as their standard by the churches of Syria and the East. A very antient MS. of the Syriac version was brought by Dr. Buchanan from a Syrian church in India, and is now in the library of the University of Cambridge.

The version of the Old Testament was first printed in the Paris Polyglott, but from an imperfect manuscript; the passages which were wanting were indifferently translated by Gabriel Sionita from the Vulgate. This text, revised by the help of four MSS., was reprinted in Walton's Polyglott. The version of the New Testament was first brought into Europe by Moses of Mardin, who was sent by Ignatius, the patriarch of the Maronites, on a mission to Pope Julius III. in 1552. It was first printed at Vienna in 1555, at the expense of the emperor Ferdinand I.

There is a later and very inferior translation of the books of the New Testament which are wanting in the Peshito, namely, the second Epistle of Peter, the second and third of John, the Epistle of Jude, and the Apocalypse, made from the original Greek, probably in the sixth century.

2, The Philoxenian, or Syro-Philoxenian Version of the New Testament, is so called from Philoxenus, bishop of Hierapolis, in the province of Aleppo (488-518), under whose auspices it was translated by Polycarp. It was revised by Thomas of Heraclea in 616. It is translated from the Greek text, but is very inferior to the Peshito.

The remaining Syriac Versions are not of sufficient importance to require a separate notice. They are described, with the Peshito and Philoxenian, in Marsh's notes to his translation of the 'Introduction' of Michaelis, Wiseman's 'Horæ Syriacæ,' and the 'Introductions' of Horne and Jahn.

A list of the editions of the Syriac Versions is given in the 'Bibliographical Appendix' to the second volume of Horne's 'Introduction.'

SYRIANES. [RUSSIA; SLAVONIANS.]

SYRIA'NUS, a Greek philosopher, born at Alexandria or at Gaza, was the leader of the school of New Platonists at Athens, next after its founder, Plutarch, the son of Nestorius. He died in the year 450 A.D. His works, the greater number of which are lost, are enumerated by Suidas. They are:—1, 'A Commentary on Homer,' in seven books; 2, 'On the Republic of Plato;' 3, 'On the Theology of Orpheus;' 4, 'On the Gods of Homer;' 5, 'On the Harmony of Orpheus, Pythagoras, and Plato;' 6, 'Ten Books on the Oracles.' The two following works are extant:—7, 'A Commentary on some parts of Aristotle's Metaphysics;' and, 8, 'A Commentary on the Rhetoric of Hermogenes.'

The Greek text of the Commentary on Aristotle was edited by Leonh. Spengel, in his Συναγώγη Τεχνῶν, 1828, 8vo. Bagolini found a Latin translation of a portion of the work in a MS., and published it at Venice, 1558, 4to. The Commentaries on Hermogenes are contained in the second volume of the Aldine edition of the Greek orators, in 2 vols. folio, 1508-1509, and in the 'Rhetores' of Walz, vol. iv., 1833.

He was also the author of two epigrams, one of which is printed without a name in the Palatine Anthology, ii., p. 122; or in the edition of Jacobs, iv., p. 233; the other is preserved by the Armenian philosopher David, and printed by Schöll.

(Schöll's *Geschichte der Griech.-Lit.*, iii., pp. 50, 182, 375; Hoffmann, *Lexicon Bibliographicum*.)

SYRINGA (from 'syrinx,' σύριγξ, a pipe), the name of a genus of plants belonging to the natural order Oleaceæ. The English name of this genus, lilac, in derived from *lilag*, the Persian for a flower. It is known by a small 4-toothed calyx; funnel-shaped corolla, with a 4-parted limb; 2 stamens; a trifid stigma; a 2-celled, 2-valved, 2-seeded capsule; the valves boat-shaped, with a dissepiment in the middle. The species are natives of Europe and the colder parts of Asia; they are deciduous shrubs, with simple leaves, having purple or white flowers, which are arranged in beautiful thyrsoid terminal panicles, and are very fragrant.

S. vulgaris, the common lilac, known by its ovate heart-shaped pointed leaves. It is a native of Persia, Hungary, and the borders of the Danube. Dr. Sibthorp found it wild on Mount Hæmus, but not in Greece. This shrub has been long cultivated by the Turks, and was brought from Constantinople to Vienna by the ambassador Busbequius, in the middle of the sixteenth century, from whence it spread over the rest of Europe. It is now one of the commonest ornaments of our shrubberies, blossoming, together with the laburnum, in May. It is one of the few shrubs that resists the injurious influence of the smoke of cities, and flourishes in great perfection in most of the squares of London. It grows to the height of 20 feet and upwards, and sends up from the parent stem an abundance of suckers, which, if allowed to grow, form a dense mass of stems; these are commonly left, but if cut down as they are produced, the parent stem may be trained so as to grow as a small tree. It grows very fast, as much as from eighteen inches to three feet in the year, and endures, according to the soil, for twenty to fifty years. It is frequently planted, either alone or in combination with other shrubs, for the purpose of forming ornamental hedges for gardens, &c. The plants with which it is sometimes mixed in this way are the sweetbriar, the white and scarlet thorn, the Guelder rose, &c. Several varieties of the common lilac are found in shrubberies, the best known of which are the common blue lilac (*S. v. cærulea*), which is known by its blue flowers: the common purple lilac (*S. v. violacea*), frequently called the Scotch lilac, also known by the colour of its flowers; and the common white lilac (*S. v. alba*), with white flowers: this last flowers the earliest. There are also two varieties with red flowers, one of which is the *Lilas de Marly* of the French gardeners.

S. Josikea, Josikas lilac, has elliptic lanceolate, acute, ciliated, wrinkled, glabrous leaves seated on short petioles, and white on the under surface, and purple flowers. It is a native of Transylvania, and was discovered by the Baroness von Josika, after whom it was named by Jacquin. It attains the height of six or eight feet, and has broad leaves, shining and dark green above and hoary beneath. It grows in damp shady places near water. Though very dissimilar in appearance to the common lilac, it has been suspected to be only a variety of that species. It is not yet very common in our nurseries.

S. Persica, the Persian lilac: leaves small, lanceolate: flowers purple. It is a native of Persia, and is a small shrub, from four to six feet high. It is one of the most ornamental of low deciduous shrubs, and on that account is very commonly cultivated. When planted in pots and forced, it may be made to flower at Christmas; but by this process the fragrance of the flowers is lost. Of this species also three varieties are found in the nurseries, the white, the cut-leaved, and the sago-leaved Persian lilacs.

S. Chinensis, Chinese lilac: leaves ovate-lanceolate; flowers purple. It is a native of China. In characters it is intermediate between *S. vulgaris* and *S. Persica*, and agrees with a hybrid plant produced at Rouen by M. Vain, and called *S. Rotomagensis*, the Rouen lilac. It is a plant that grows vigorously, and attains a height of ten or twelve feet. The sorts known in nurseries as the Belgic *Lilas de Marly* and the *Lilas saugé* are varieties of this species.

S. Emodi has elliptical-oblong leaves, glaucous beneath, attenuated at the base, and acuminated at the apex with purple flowers. It is a native of Kumaon near the Himalaya. The *S. villosa* has villous leaves, and is found in China on mountains about Pekin, but neither of these species is cultivated in this country, although both would probably bear this climate.

All the lilacs will grow in almost any kind of common soil; the best way of propagating them is by the suckers which they send off in so great abundance. They may be grafted on privet or ash stocks, and in this way the inconvenience of their great produce of suckers may be got rid of. (Loudon's *Arb. et Frut.*, vol. ii.; Don's Miller, iv.)

Syringa is also the name that is commonly but improperly given to the species of Philadelphus, or Mock-orange. The name Syringa was given to the lilac on account of its stems being used for the manufacture of Turkish pipes. The stems of the Philadelphus coronarius are also used for the same purpose, and equally with the lilac it had the name of Pipe-privet, or Pipe-tree, given it when first introduced into this country, and afterwards the name Syringa. [PHILADELPHUS.]

SYRINGE (from Σύριγξ, a pipe), a portable hydraulic instrument of the pump kind, commonly employed for the forcible ejection of fluids. In its simplest form it consists of a cylindrical tube, with a perforated nozle at one end, and a piston or plunger, to the rod of which a ring or other convenient handle is attached. The tube being held in the left hand, with its nozle immersed in water, the piston is drawn to the upper end of the tube by the right hand. The pressure of the atmosphere upon the surface of the water causes it to follow the piston, so that the syringe becomes filled with water. The instrument is then removed from the vessel of water, and, by pushing the piston back towards the nozle, its contents may be ejected with a force proportionate to the power applied to the piston. Syringes of various sorts are extensively used for surgical, horticultural, and other purposes, a few of which may be briefly noticed.

The use of syringes for extinguishing fires is alluded to under FIRE-ENGINE, vol. x., p. 277. Syringes for this purpose appear to have been much used in London before larger and more perfect engines became common. Hebert (*Engineer's and Mechanic's Encyclopædia*, vol. i., p. 505) mentions some of these, which are still, he says, preserved in the vestry-room of St. Dionis Backchurch in Fenchurch Street, and which are supposed to have been used at the great fire of 1666. He describes such instruments as being usually made of brass, and holding from two to four quarts each. 'Those of the former capacity were,' he says, 'about two feet and a half long, and one inch and a half in diameter, that of the nozle being half an inch. They were furnished with handles on each side, and every syringe required three men to work it. One man on each side grasped the handle in one hand and the nozle in the other, while a third man worked the piston or plunger, drawing it out while the nozle was immersed in a supply of water, which filled the cylinder; the bearers then elevated the nozle, when the other (man) pushed in the plunger, the skill of the bearers being employed in directing the stream of water upon the fire.' The large syringes used for horticultural purposes might, in many cases, be used with advantage on the first discovery of a fire, when a very small quantity of water, promptly applied and accurately directed, might prevent serious mischief.

Garden-syringes are made either to throw water in a compact jet, from a simple nozle with one perforation, or to distribute it in the form of a shower, from a rose perforated with a number of small holes. In the latter case especially, as time would be lost in filling the syringe if the water were compelled to enter through the fine perforations by which it is ejected, it is usual to add a nozle of comparatively large bore, through which water is allowed to enter, although a self-acting valve prevents it from returning the same way. Several different caps may be fitted to the same syringe; those for throwing jets having the injection and ejection nozles side by side, while those for producing showers have the injection nozle in the centre of the rose. In some cases the water is thrown from such syringes against a wall, that it may rebound so as to wash the back or under surface of the leaves, in order to remove the eggs of insects deposited upon them; and some syringes are made with curved nozles, for use in a similar way. Their portability renders instruments of this kind particularly useful in conservatories. Syringes may also be applied with advantage in washing carriages, cleaning windows, and for other useful purposes.

In medicine and surgery syringes of various kinds are employed in administering clysters; in injecting fluids into, or removing them from, the stomach or bladder; injecting liquids into wounds; and injecting coloured liquors or melted wax into veins, &c., in anatomical preparations. The application of the syringe as a stomach-pump is peculiarly important. In this case a flexible tube is put into the mouth of the patient, with a guard between the teeth to preserve it from injury, and a branch pipe is added to supply the syringe with liquid from a vessel, when it is used for injection, and to afford a channel for the escape of the abstracted liquid when the syringe is employed to empty the stomach. By an ingenious arrangement of valves, the same instrument may be so modified as to act equally well in either way. One method of using such an instrument is, first to inject a diluent into the stomach, and then to pump it back again, together with the injurious matter which it is desired to remove; and another plan sometimes found advantageous, is to inject a fluid into the stomach until an involuntary discharge takes place through the mouth, and to continue the operation until the stomach is cleansed, this being indicated by the fluid returning unchanged. A similar instrument may be used for injecting tobacco-fumes into the intestines. Syringes are also used for similar purposes in veterinary surgery.

The pneumatic instruments known as exhausting and condensing syringes are described under AIR-PUMP, vol. i., p. 239. A kind of condensing syringe for igniting tinder by the sudden compression of air has been contrived, though not brought much into use. It is sometimes made in the form of a walking-stick.

In 1822 Mr. James Harris, of Plymouth, communicated to the Society of Arts a method of preserving oil-colours for painting in syringes formed of tin, or of brass tinned internally. The details of his plan, which possesses several advantages over the common method of tying up the colours in pieces of bladder, are given in vol. xli. of the Society's 'Transactions.' A similar contrivance, in which the syringe is formed of glass, and other details are different from Mr. Harris's, although the same principle, that of propelling the piston by means of a screw, is preserved, has been lately brought much into use; and, still more recently, tubes of very thin metal have been adopted, from which the colour is expressed by collapsing the tube between the finger and thumb, without the use of a piston.

(Jamieson's *Dictionary of Mechanical Science*; Hebert's *Engineer's and Mechanic's Encylopædia*; &c.)

SYRINGO'DEA (from σύριγξ, *a pipe*, on account of their long tubular corolla), a genus of plants belonging to the natural order Ericaceæ. This genus was formed by David Don out of the old genus Erica. It possesses the following characters: calyx 4-leaved, glumaceous; corolla long, tubular, usually rather dilated at top, rarely a little contracted; limb short, 4-lobed; stamens for the most part inclosed, filaments capillary, anthers 2-parted, cells of anthers short, obtuse, mutic or aristate at the base, dehiscing by an oblong foramen; stigma simple or capitate, and in some species annulated with an elevated disk; capsule 4-celled, many-seeded; seeds oval, compressed, smooth. (Don's Miller, iii.) The species, of which one hundred and twelve are described by George Don in Miller's Dictionary, are all natives of the Cape of Good Hope. They are erect shrubs, with loose leaves and large showy flowers, which are crowded at the tops of the branches on every side, and form a spike-like inflorescence. In their cultivation they require the same treatment as heaths. [ERICA.]

SYRINGO'PORA. [MADREPHYLLIÆA.]

SYROPU'LUS, or SGUROPULUS, SILVESTER, a dignitary of the Greek church, wrote a history of the Council of Florence, which was convened in 1438 A.D. by Pope Eugene IV., at Ferrara, and in 1439 removed to Florence. The principal business of the council was to settle the differences between the Greek and Latin churches. Syropulus, who was present at the council, writes in a spirit of opposition to the attempted union of the churches, and his work must therefore be considered an ex-parte statement.

This work was published, with a Latin translation and notes by Robert Creighton, an Englishman, at the Hague, 1660, folio. Its publication called forth a work on the opposite side by Leo Allatius [ALLATIUS], entitled 'Exercitationes in Creightoni Apparatum, Versionem, et Notas, ad Historiam Concilii Florentini scriptam à Sguropulo,' Rome, 1674, 4to.

(Schöll, *Geschichte der Griech.-Lit.*, iii. 323; Mosheim's *Ecclesiastical History*, cent. xv., pt. ii., c. ii., § 14, note.)

SY'RPHIDÆ, a family of dipterous insects of the section *Brachystoma* of Macquart, the species of which are distinguished by their having the palpi inflated at the extremity, the fore part of the head often with a prominence, the labrum large, arched, and emarginated; the stylet of the antennæ is usually dorsal; the abdomen is most frequently depressed and elongated; the wings have one discoidal cell, three posterior cells, the first of which is closed, and the second extends along the posterior margin of the wing; sometimes there are some small terminal nervures; the

anal cell is large, and a longitudinal nervure divides the discoidal cell, as well as the posterior.

The present family contains upwards of forty genera, a great portion of which have representatives in this country. The species frequent flowers and woods: the larvæ of the species of *Syrphus* is in the form of an elongated cone; they fix themselves, &c. with a kind of glue, and feed exclusively on aphides. Some of the *Syrphidæ* inhabit the nests of the humble-bees (*Bombus*), and these so much resemble the species of Bombi, that they might at a first glance be mistaken for them. Other *Syrphidæ* live in the larva state in water and mud; and these larvæ are provided with a long slender tail, through the extremity of which they respire, it being raised to the surface of the water or mud for the purpose.

SYRRHAPTES. [TETRAONIDÆ.]

SYRTES (*αἱ Σύρτεις*) was the name given by the Greeks and Romans to the two gulfs on the northern coast of Africa, one of which they called Syrtis Major (*ἡ μεγάλη Σύρτις*), and the other Syrtis Minor (*ἡ μικρὰ Σύρτις*). Both Syrtes were the terror of the antient mariners. The name is said to be derived from the Greek verb *σύρω* (*draw* or *drag*), from their drawing in ships and swallowing them up in their sandy shoals. Another derivation is from the Arabic word *sert* (sand), which is at this day applied to the district on the shores of the Syrtes.

1. The Greater Syrtis, now called the Gulf of Sidra, is a very large bay on the northern coast of Tripoli, lying between the promontories of Boreum (Ras Teyonas) on the east, and Cephalae (Ras Kharra) on the west, the distance between which is 230 geographical miles: its greatest depth is about 110 geographical miles. Strabo (p. 835-6) gives 930 (or, according to the correction of Casaubon, 5000) stadia for its circuit, 1500 for the diameter of its mouth, and about the same for its depth. The Sahara, or Great Desert, here comes down almost to the sea, leaving here and there only a narrow strip of land inhabitable. The gulf is very shallow and full of quicksands, and the coast is covered by a chain of little islands. On this dangerous shore it was difficult to prevent ships from being driven by the north winds, to which the gulf is completely exposed, while the effect of such winds on the water made the soundings very uncertain. Under all these difficulties the great terror of the antient mariner in these parts was 'lest he should fall into the Syrtis.' (*Acts of the Apostles*, xxvii. 17.) Strabo (p. 836) describes the difficulties of this and the Lesser Syrtis as arising from the above causes, and adds that a ship once involved in them rarely escapes; and he ascribes it to the singular audacity of men that they ever attempted to navigate the coasts of the Syrtes.

2. The Lesser Syrtis, now called the Gulf of Khabs, on the southern corner of Tunis, lies between the promontory of Brachodes, or Caput Vada (Ras Kapondiah), on the north, and the island Meninx (Jerbah) on the south. Besides this island, those of Cercina and Cercinitis (Karkennah) lie in its mouth, the width of which was generally reckoned from these islands to that of Meninx, and was estimated at 600 stadia, or 60 geographical miles (Agathemerus, i. 5; Eratosthenes, ap. Strabo, p. 834), which is the real distance. Eratosthenes (*l. c.*) gives 1600 stadia for the circuit of the coast. The Roman writers, measuring from other points, give larger results than the above, namely, 100 Roman miles for the width of the mouth, and 300 for the circuit. (Mela, i. 7; Plin., v. 4.) This gulf is said by Scylax (p. 48) to be even more dangerous than the Greater Syrtis. Its dangers arise however not so much from quicksands as from 'the variations and uncertainty of the tides on a flat shelvy coast.' (Rennell.)

The Syrtes were known to the Greeks in very early times. Herodotus mentions only one of them by the name of Syrtis (ii. 32, 150; iv. 169). It is generally thought that in these passages Herodotus means the Greater Syrtis, and that his Lake Tritonis is the Lesser. He states (iv. 178-9) that Jason, when on a voyage to Delphi prior to the Argonautic expedition, was driven by a north wind from Malea into the shallows of Lake Tritonis, but he nowhere speaks of the dangers of the gulf which he calls Syrtis. His allusions are very difficult to explain. Müller supposes that the story about Jason refers to the Greater Syrtis (Orchomenus, p. 354); and Niebuhr contends that wherever Herodotus speaks of the Syrtis, he means the Lesser. ('Vermischte Schriften, i., p. 147.')

The march by land round the Greater Syrtis was difficult and dangerous. Edrisi describes a portion of the road as passing over ground in a state of solution; in fact, sand saturated by the sea-water. Strabo (p. 836) states that Cato, in marching from Berenice, through the Syrtis, was compelled to pass through deep and burning sand. In connection with this march, Lucan gives a very spirited description of the Syrtis (ix. 390, &c.).

The Lesser Syrtis is remarkable for the great variations of its tides, in consequence of the east winds, to which it lies open. The lake bordering upon it, which is now called El Sibkah, or the Lake of Marks, seems to have been once connected with the Syrtis by a channel; and this lake must be included under the Lake Tritonis of Herodotus, if we suppose the latter to be the Lesser Syrtis.

(Rennell's *Geography to Herodotus*, ii., sec. xxiii., p. 314, &c.; Heeren's *Researches, African Nations*, i., p. 33; Mannert, *Geographie der Griechen und Römer*, x. 2, pp. 106, 157; Georgii, *Alte Geographie*, p. 504; Shaw's *Travels*, p. 194.)

SYRUPS are medicinal solutions of sugar, either in water alone, as in simple syrup, or in liquids charged with some peculiar principle of an active kind, such as senna or buckthorn, or merely grateful from its colour or fragrance, or both, such as syrup of violets. These must be of a proper consistence, either by having a suitable quantity of sugar added to the water at first, or by subsequent evaporation of the superfluous water. The former is the preferable mode, as the syrup keeps better. The purest and most thoroughly refined sugar should be employed, and generally in the proportion of two parts of sugar to one of fluid. When made, the syrup is to be preserved in closely-stopped bottles, and kept in a cool place, the temperature of which never exceeds 55° Fahr.; but, with every precaution, fermentation is apt to occur, particularly if warm or boiling water has been employed to extract the vegetable principle, as is most improperly enjoined in the 'London Pharmacopœia,' in the syrup of Althaea, when cold water is most appropriate: so also with the syrup of poppies, which, when given in a state of fermentation to children, too often aggravates the disorder of the bowels it was intended to alleviate. When too little sugar is used, fermentation is still more apt to occur: when too much, the excess crystallizes. Syrups are more used for their fragrance or colour than for their medicinal properties, which few possess to any important extent. Their number might well be diminished.

SYRUS, PUBLIUS. [PUBLIUS SYRUS.]

SYSRAN. [SIMBIRSK.]

SYSTEM (Mathematics), a word little used: we hear sometimes of a system of equations, or a system of curves or surfaces; the former meaning a set of equations which are related to each other in the same problem, the latter a class of curves or surfaces which are connected by any law.

SYSTEM (Astronomy). This term is applied to every theory of the disposition and internal arrangements of the solar system, or of the material creation generally. Thus we have the system of Ptolemy, of Copernicus, &c. Perhaps a short description of the distinctive characters of the different systems may be useful in a work of reference.

Ptolemaic.—The earth is an absolutely fixed centre, and the planets revolve in circles about centres which themselves revolve round the earth. [PTOLEMAIC SYSTEM.]

Copernican.—The sun is a centre, round which the planets revolve. Some of the machinery of the Ptolemaic system is retained.

Tychonic.—The sun is a centre of motion to all the planets, which revolve round it, while the sun and planetary orbits are carried together round the earth as a fixed centre.

Semi-Tychonic.—The sun is a centre of motion to Mercury and Venus, as in the Tychonic, and the motions of the other planets are as in the Ptolemaic system.

Newtonian.—There is no fixed centre, the sun only approximating to that character from its greater magnitude. The orbits of the planets are approximately represented by ellipses, exactly by ellipses of which the elements vary.

The Newtonian system is frequently called Copernican, from its rejecting what Copernicus rejected; but it is far from receiving all that Copernicus received. The introduction of the ellipse is due to Kepler. We have not included the system of Des Cartes [VORTICES] because it has reference to physical causes, and contains no peculiarity of arrangement. [PTOLEMAIC SYSTEM; BRAHE, TYCHO; COPERNICUS; NEWTON; PRINCIPIA; GRAVITATION; SOLAR SYSTEM, &c.]

The term system is also applied to the subdivisions of the solar system: thus we have the terrestrial, Jovial, Saturnian, Uranian sytems.

SYSTEM, PTOLEMAIC. This article would have come under SYNTAXIS, but for circumstances which occasioned delay.

In the article PTOLEMAIC SYSTEM we have explained the principal points of that system as exhibited by the followers of Ptolemy, and in the form in which it was attacked by the followers of Copernicus and Galileo. Our present article has reference to Ptolemy personally, and to his astronomical writings. We shall begin by a short account (from Delambre) of his μαθηματικὴ σύνταξις, or mathematical syntaxis, which obtained from his commentator Theon the name of μεγάλη σύνταξις, or great Syntaxis, shortened and heightened by the Arabs into ALMAGEST.

BOOK I. Ptolemy gives notice that he intends to state briefly all that has been well done or well known before him, and to enlarge upon what has not. He gives his proofs, physical and metaphysical, that the earth is spherical and fixed, and that the primary motion of the stars is circular; as also that the earth is the centre of the universe. One sphere produces the diurnal motion, another that of the precession: his expressions in this chapter do not settle the point whether he believed in the solid spheres, or only considered them as an hypothesis. He describes the theory and construction of his table of chords, and two instruments for observing the solstices, and deducing the obliquity of the ecliptic. It is doubtful from his expressions whether he had ever used the first, which is the better of the two, and whether the second could be made available. He gives no observations, and his result is that the distance of the two tropics is between 47⅔° and 47¾°, which is very nearly that of Hipparchus, without any allowance for the diminution which must have taken place between the times of Hipparchus and Ptolemy. He applies the table of chords to find the degrees of the equator and ecliptic which come on the meridian together.

BOOK II. Dividing the earth into four parts by the equator and one meridian, Ptolemy begins by assuming that one only of those parts is habitable. This part he divides into portions or climates by the lengths of their longest days. The latitudes are found from the gnomon; but in the examples Rhodes (where Hipparchus observed), and not Alexandria, is chosen: Delambre suspects that these examples are taken from Hipparchus, and that negligently. He fixes the times when the sun will be in the zenith of a given place, gives the method of determining the longest day, describes the various climates above mentioned up to the pole, converts the ordinary mode of reckoning time (namely, twelve hours to the day and twelve hours to the night, differing at different times of the year) into sidereal time, and enters into details, and gives tables, on the position of the ecliptic in various latitudes with respect to the horizon. He speaks of the table of longitudes and latitudes given in his Geography.

BOOK III. Ptolemy gives the reasons for the tropical year being preferable to the sidereal. He contends for the tropical years being all of the same length, in opposition to Hipparchus, who, he affirms, suspected an inequality: this point, as between Hipparchus and Ptolemy, is discussed at length by Delambre. Hipparchus had determined the length of the year by comparing his own solstices with those of Meton and Euctemon, and had made it upwards of six minutes too long. Ptolemy compares his own equinoxes (as he says) with those of Hipparchus, and, though the interval was nearly 300 years, contrives to produce the result of Hipparchus. This has caused Ptolemy to be suspected of inventing equinoxes, and not observing them; and, it must be allowed, not without strong reason. This very curious point is also discussed at length by Delambre. This third book also contains the solar theory, in which the orbit of the sun is supposed to be a simple excentric. Ptolemy avowedly agrees with Hipparchus in the main points of this solar theory, and adds, without mention of the latter, a true account of the equation of time, specifying the two main parts of which it consists. This was misunderstood by Ptolemy's successors, and it was not until the time of Newton that the error was set right (by Flamsteed). Delambre is inclined to suspect that as Hipparchus really had the elements of the equation of time in his possession, the want of mention of his name is not to be considered as conclusive in favour of Ptolemy.

BOOK IV. After describing the advantage of using eclipses for determination of the moon's place, and mentioning the well-known Chaldean SAROS (referring however only to antient authors generally), Ptolemy proceeds to give his values of the daily motion of the moon, both with respect to the stars, her perigee, and her node. In the first he agrees with Hipparchus, and in the second and third makes such trivial alterations in the results of the latter, that it is difficult to see how he could have thought his own observations good for such small quantities. After mentioning that all his predecessors, without exception, had seen only one inequality in the lunar motion, he makes mention of a second (see the next book). The first inequality (the equation of the centre) he combines with the motion of the apogee by an epicycle. The description of the eclipses, from which he detects the amount of this inequality, is followed by the process. He then proceeds to the motion of the node, which he detects by observation of distant eclipses presenting the same phases. In the whole of this chapter he is apparently following Hipparchus.

BOOK V. This book contains the account of the discovery of the evection [MOON], of which even Delambre admits that this one discovery would place Ptolemy in the first rank of astronomers; but not without observing that it appears from Ptolemy himself that Hipparchus had felt the want of a second inequality, but had not time or opportunity to work it out. This complicated inequality depends upon the positions of the sun and moon with respect to the moon's perigee: it was ascertained by comparison of eclipses, and represented by placing the epicycle of the former inequality upon a revolving excentric. He then proceeds to the subject of the distances of the sun and moon from the earth. Hipparchus had doubted whether the parallax of the former was appreciable, but had not ventured to suppose it less than 3′. Ptolemy brings nearly the same result, and so makes the sun's distance about the twentieth part of its real amount: in that of the moon he is not so correct as Hipparchus.

BOOK VI. This book is devoted to eclipses, the determination of the limits within which they are possible, and their prediction in the case of lunar eclipses. He appears not to have had any reliance on his own theory for a solar eclipse.

BOOK VII. Ptolemy notes most particularly the apparent positions of the fixed stars, comparing them with those given by Hipparchus, to prove that the precession affects them all equally. So very numerous are his observations, considering the paucity of those which he gives on much more important and doubtful subjects, that some have doubted whether he ever really did observe anything with instruments in the matter of the fixed stars. Hipparchus made the precession to be one degree in a hundred years, instead of seventy years; and Ptolemy takes care to verify his result by a most suspiciously close accordance of observations. The celebrated catalogue which this book contains was observed by Ptolemy himself, as he says, though it has been suspected that he merely added his own and Hipparchus's value of the precession to the longitudes of the latter. No star is contained in it which could not be seen at Rhodes, though there are several which an Alexandrian observer might have added. Longitudes and latitudes, not right ascensions and declinations, are employed, and Ptolemy states that they were directly observed. The number of stars is 1022, rather less than that in the catalogue of Hipparchus. Delambre's comparison of the distances of stars from each other, as compared with those deduced from Ptolemy, is elaborate.

BOOK VIII. The Milky Way is described. The construction of artificial globes is pointed out in a manner exactly resembling that in use at present. Long details follow on the rising and setting of the stars with respect to the sun.

BOOKS IX., X., XI. These books treat of the motions of the planets: the first generally, and of Mercury in particular; the second of Venus and Mars; the third of Jupiter and Saturn. Hipparchus, Ptolemy says, had hardly commenced this subject. He places Venus and Mercury between the earth and sun, in opposition to the opinion held by some. He recognises two distinct motions: the first what we should now call the motion of the planet round the sun; the second arising from that of the earth round the sun. His principal apparatus is an excentric, with a revolving motion, on which the planet moves in an epicycle. In the case of Mercury and Venus, the epicycle answers to the orbit of the planet; in Mars, Jupiter, and Saturn, to the orbit of the earth. In the first cases, the motion of the centre of the epicycle is that of the sun; in the second, the motion in the epicycle. This obvious dependence of the motions of all the planets upon that of the sun leads to no

remark upon the possibility of the sun itself being the centre of their epicycles. The complication of these hypotheses, which afterwards became so striking, begins in an attempt to represent the motion of Mercury by an additional circle.

Book XII. contains the deduction of the phenomena of stationary and retrograde motion in the planets from the theory already laid down.

Book XIII. contains the modifications of the positions of the epicycles which were necessary to represent the planets' motions in longitude; and also an account of the distances from the sun at which they begin to appear.

The first account of the Optics of Ptolemy was given by Delambre (*Hist. Astr. Anc.*, vol. ii.), from a Latin manuscript translation in the Royal Library at Paris. Montucla and others were only able to speak of it from the presumption that Alhazen had copied it: among other mistakes which this gave rise to was the attributing to Ptolemy a good explanation of the apparent enlargement of the sun and moon near the horizon. It contains, among many errors and some good experiments on the passage of rays from one medium into another, a distinct statement of the fact of atmospheric refraction, of its tendency to raise the stars towards the zenith, and its increase with the zenith distance of the star: the phenomenon being attributed to its true cause, the alteration of density in the media which the light traverses. That Ptolemy wrote on Optics is certain, and Delambre seems to take it for granted that this translation in the Royal Library is really that of Ptolemy's work from the Arabic. There are other copies mentioned in library catalogues, and a proper comparison and critical discussion of the claims of the work will no doubt one day arrive.

The work on the Planisphere, attributed to Ptolemy, has also come down through the Arabic. It is on the stereographic projection, which was known to Hipparchus; and Proclus mentions the work of Ptolemy as being modelled on that of Hipparchus. The other work on the Analemma (an instrument intended to facilitate the construction of sun-dials) is also only known by translation from the Arabic. The Τετράβιβλος, a work on astrology, has come down in Greek, with the paraphrase of Proclus. All these works are fully described by Delambre, with whom it was a labour of love (towards Hipparchus) to sift the writings of Ptolemy.

The fate of the Ptolemaic system, since the Galilean reform, is a close parallel with that of the Roman church in England. The advocates of the now established system, remembering only the opposition with which their opinions were met by those once in power, and forgetting the services which the older establishment had rendered through a long period in which no opposition was dreamed of, exhausted the powers of language in undiscriminating depreciation; and Ptolemy, who was the astronomer's best guide (and no bad one either, all things considered) for centuries, and the monasteries which preserved all literature through the same period, are only known and spoken of as the destroyed of Copernicus, or the denounced of Luther. In time, a tardy justice is done, and never was there an instance in which it was more required than that of the Syntaxis.

If we look at the immense mass of labour which Ptolemy left behind him, to say nothing of the works which have been lost, and consider that not one fragment of it exists which did not actively exercise minds of all degrees of power from the first translations of the Arabs to the middle of the seventeenth century, we may form a slight idea of the effect of his writings. Only Aristotle, of all the antients, can be compared with Ptolemy in the commanding character of his influence.

As to his astronomical observations, we see no reason to decline to follow Delambre, who has, we think, shown, almost to demonstration, that Ptolemy was perhaps not an observer at all, and that at most his observations must have been of the rudest kind, compared with those of Hipparchus. It is from Ptolemy himself that we learn this; for there is no one to confront with him: in stating most plainly where he follows Hipparchus, in conducting his imitations or adaptations of the latter with a degree of openness which invites attention to the source from whence he drew, and, above all, in the candid admiration with which he expresses himself on the subject of his predecessor's merits, he earns, or ought to earn, confidence when he expressly attributes anything to himself. The epithets which he bestowed on Hipparchus, the lover of toil and truth (φιλόπονος καὶ φιλαλήθης), may well be added to his own name.

It is as an astronomical theorist that Ptolemy has earned the fame which outlasts his system. His much abused epicycles were no other than a geometrical representation of the process which a modern analyst would have been obliged to follow under the same circumstances. If a periodical magnitude is to be represented, a series of sines or cosines is chosen, the angles of which depend upon the periods of the observed inequalities, and the coefficients upon their extreme magnitudes: this is precisely the algebraical representation of the process of Ptolemy. A question has arisen as to whether he himself believed in the solid crystalline orbs which his followers placed in the heavens. Some of his phrases would imply that he leaned to such a belief, but a much larger number are expressive only of an hypothesis which *saves appearances*, to translate literally, or represents phenomena. Had he really adopted such a material mechanism, he, who could argue that celestial motions must be circular, because circular motions are the most perfect, would not have been without some *à priori* reason for the solidity of his planet-carriages. If he had had a better physical system, the state of mathematics would not have permitted the use of it; and Copernicus himself had no more satisfactory mode of explaining the inequalities of the planetary motions than these same epicycles; nor, as we have said, could a modern astronomer, with new phenomena to represent, and no physical cause to refer them to, do otherwise than adopt the same course, in trigonometrical language, instead of geometrical. The methods of Ptolemy are those of a great mathematician; and the explanation of the equation of time, of the evection of the moon, and of the planetary orbits, are, the two first absolutely, and the third as compared with anything which preceded, masterpieces of success, the last of which has only lost its glory because the pertinacity of his distant followers led them to put a mathematical explanation in the place of a physical one. Delambre, who hints hard, and we think unfairly, at a division of the merit of the two former with Hipparchus, sees in the method proposed by Ptolemy for the representation of what we now call the excentricity of Mercury's orbit, the circumstance which suggested the ellipse to Kepler.

The Syntaxis and other works of Ptolemy fell into the hands of the Arabs, and gradually went out of sight in Europe, as did most other Greek writings: the first was translated into Arabic, Persian, and Hebrew. The bibliographical history of Ptolemy's works might almost make a small volume; and we must here content ourselves with a short abstract of the principal points, referring for the rest to Fabricius's 'Bibliotheca Græca.' The first work printed was the book on astrology (1484 and 1493).

1515, Venice, folio. First Latin translation of the Almagest from the Arabic: manuscript and translator unknown, once thought to be Trapezuntius—'Ductu Petri Liechtenstein, Coloniensis Germani.'

1525, Venice, folio. Latin translation by George of Trebizond (Trapezuntius), said to have been made from the Greek: reprinted in 1527 (?), and 1528 by Gauricus, and in 1551 (Basle).

1536, Basle, 4to. The Planisphere (in a collection). 1558, Venice, 4to., the same, with Commandine's Commentary.

1538, Basle, fol. The first Greek edition, with Theon's Commentary and that of Pappus on the fifth book: by Grynæus, from a Nürnberg manuscript obtained by Cardinal Bessarion.

1541, Basle, folio. Third Latin translation (all the works except the Geography). This is Trapezuntius, edited by Schrekenfuchsius.

1549, Wittenberg, 8vo. The first book of the Syntaxis (Greek), by Er. Reinhold: again in 1560, Paris, 8vo.

1556, Paris, 8vo. First and second book of the Syntaxis (Latin, S. Gracilis).

1562, Venice and Rome, 4to. The Analemma, with Commandine's Commentary: again in 1572, Rome.

1569, 8vo. Canones Art. Math. (Gr., Lat.), by Reinhold.

1620, London, 4to. De Hypothes. Planet., by Bainbridge. [Ptolemaic System.]

1630, Paris, folio. De Apparentiis Inerrantium, &c. (in the Uranologion of Petavius); first printed in Greek in the third volume of the Bibl. Græca of Fabricius (1718, 1728).

1786. Nancy, 4to. Montignot's French edition of Ptolemy's Catalogue (according to Fabricius, Strassburg, 1787).

1813. Paris, 3 vols. 4to. The splendid Greek and French edition of the Syntaxis, by M. Halma.

The thirteenth volume of the Memoirs of the Astronomical Society, now preparing, will contain a fully revised and collated edition of Ptolemy's Catalogue (with others), by Mr. Francis Baily.

SYSTEM, in the musical language of the Greeks, had the same signification as the word Scale has in modern music. [SCALE.] Each of the many genera of the antients was a system in itself if we may venture to assert anything positively concerning a subject which is, and seems likely to be for ever, involved in much obscurity. [GENERA.]

In modern music the term *System* is applied to any theory of harmony, that is to say, of the origin of chords, and of the manner of treating them in composition. Thus we have the systems of Rameau, Tartini, Kirnberger, &c., which see under the names of their respective authors. The System of Guido d'Arezzo, or that ascribed to him, included the elements of our present mode of notation; also the division of the scales into hexachords, and a mode of solmisation founded on such division. [GUIDO; HEXACHORDS.]

SYZYGIES AND QUADRATURES. The syzygies of a planet or of the moon are those points of its orbit at which it is in conjunction or opposition with the sun: the quadratures are the precisely intermediate positions. Thus at new and full moon the moon is in syzygies; at half moon, in quadratures.

SYZY'GIUM, a large tropical genus of plants of the natural family of Myrtaceæ, so named from sy'zygos (σύζυγος), coupled, in consequence of the manner in which the branches and leaves are united together in pairs. The calyx-tube is obovate, with the limb nearly entire. Petals 4-5, forming a calyptra. Stamens numerous, free. Style single. Stigma simple. Ovary 2-celled, ovules several in each cell. Berry one-celled, one or few seeded. Trees or shrubs of a highly ornamental appearance from their smooth shining leaves, which are opposite and entire.

Of the species *S. Guineense*, a native of the coast of Guinea and Senegal, has been employed as a remedy in rheumatism. *S. paniculatum*, a native of the Isle of Bourbon, is there called *Bois à ecorce blanche*. *S. Jambolanum* is a native of the East Indies, and there most extensively diffused, being planted near villages in clumps of trees, chiefly on account of its fruit, which is sometimes called Java plum by Europeans, but Jamoon by the natives. It is of a rich purplish colour, but of a subastringent sweetish taste, which is more agreeable to the native than to the European palate. The fruit is sometimes soaked for an hour in salt and water, when it makes an approach to the flavour of olives. The bark is astringent, and dyes of a brown colour: the wood is hard, close-grained, and durable, and therefore much employed.

SZATHMAR is a county in the kingdom of Hungary, with an area of 2230 square miles, and 212,875 inhabitants, of whom the Hungarians are the most numerous; next to them are the Wallachians, some Germans, Russniaks, Slavonians, and 4000 Jews. [HUNGARY, *Circle beyond the Theiss*.] They are of the Roman Catholic, Greek, Lutheran, and Calvinist religions. The rivers are the Theiss, Szamos, Kraszna, and Tur. The eastern corner of the county is covered with mountains, which are very rich in gold, silver, and other metals. The western part of the county, which is by far the largest, has no mountains, but forms a portion of the great plain of the kingdom of Hungary. The climate is healthy, and the soil in the plain very fruitful, producing abundance of wheat, maize, flax, hemp, tobacco, and fruit. The sides of the mountains, to a great extent, are covered with vineyards, which yield excellent wine. In the mountainous parts, especially about Nagy (*i.e.* Great) Banja, there are good breeds of oxen, sheep, and swine, and great quantities of bees: honey and wax are important articles of commerce. In the large forests there is abundance of game, and some beasts of prey, wolves, foxes, and bears. In the marshes there are large flocks of water-fowl; and in the rivers, especially the Szamos, many kinds of fish. The country is very rich in minerals, viz. gold, silver, lead, copper, zinc, antimony, arsenic, amethysts, chalcedony, jasper, porphyry, granite, sandstone, basalt, saltpetre, brimstone, and soda. Of the two royal free towns in this county, the largest is

SZATHMAR-NEMETHY, which was formed in 1725 by the union of two towns, Szathmar and Nemeth, which are separated by the river Szamos. The part called Szathmar is in an island in the river, and is surrounded with a wall. The principal public buildings are the cathedral, and one Roman Catholic, two Greek, and two Protestant churches; the handsome townhouse, the residence of the bishop, formerly a Jesuits' convent, and the seminary. This town is the see of a bishop, with six canons, founded in 1804, by the emperor Francis. The bishop has under him a theological seminary, a gymnasium, a lyceum, and normal school. The Greeks and Protestants have also their schools in both parts of the town. In the environs there are extensive vineyards and plantations of plum-trees. The fruit of these trees, dried or pounded, and the brandy distilled from it, are highly esteemed, and are considerable articles of commerce, large quantities being exported. The population is about 15,000; the inhabitants manufacture linen and earthenware, and have some trade.

Nagy Banya, the second and smaller city, is situated in a fine valley surrounded by mountains, in the eastern part of the county, about 10 miles from the frontier of Transylvania. It was formerly called in Latin, *Rivuli Dominarum*; and in German, *Frauenbach*; but at present in all languages it is called by the Hungarian name, Nagy Banya, which means a great pit or great mine. It is not known what nation first began to work the mines in the neighbourhood: in 1142 Geysa II., king of Hungary, settled a colony of miners from Saxony in this place. It is probable that the mines had been previously worked, and that the want of skilful workmen induced the king to send for Saxon miners. The town has a handsome square, which appears to have been long surrounded by good buildings, but the town in general is ill built and irregular. The inhabitants, about 5000 in number, are half Roman Catholics, and half Protestants, chiefly Calvinists. They have manufactories of linen, cotton, pottery, and crucibles, and carry on a good trade in earthenware, litharge, fruit, and chestnuts, of which there are extensive forests in the environs. The mines of gold, silver, and lead in the surrounding mountains are among the richest in Hungary.

Nagy Karoly, the largest town, though not a city, is the capital of the county, and has above 11,000 inhabitants, who raise excellent corn, maize, and tobacco, and make wine. They also manufacture linen and cotton, and make large quantities of boots and shoes for exportation. The town is of considerable extent, has a handsome square, a county-house, a town-house, and several churches and chapels; a college of the Piarists, a gymnasium, and a primary school. There is here also a very fine palace of Count Karoly, with extensive gardens, an excellent stud, and a Swiss farm, where a great number of buffaloes are bred. In the neighbourhood there is a park in which there are wild boars and hogs, and a preserve for pheasants.

Felso Banya, is a mining town with 4700 inhabitants, who are chiefly employed in the rich gold, silver, lead, copper, zinc, and iron mines. They also manufacture a great deal of earthenware.

(Thiele, *Das Königreich Ungarn*; Blumenbach, *Die Oesterreichische Monarchie*; *Ungarn, Sclavonien, und Croatien*, Anonymous.)

SZEGEDIN, the capital of the Hungarian county Czongrad, is situated on an eminence on the right bank of the Theiss, at its junction with the Maros. The external form of the city is a square, surrounded with circular fortifications. It is divided into the city, called Palenka, which has well-built houses, and neat but unpaved streets; the citadel, which is surrounded with walls and moats, and includes some barracks; the Upper and the Lower suburbs; and a street called Kukurntz-Varos, or the corn-market. The whole contains 32,200 inhabitants, of whom about 750 are Jews. There were formerly 20 churches and other buildings appropriated to divine worship in the city: at present there are six Roman Catholic churches, a Greek church, which is accounted one of the handsomest in Hungary, and a synagogue. Among the principal public buildings are the county-hall, the house of correction, the handsome town-house, and the great salt-magazine. There are also a Piarist college and gymnasium, a Roman Catholic high school, several hospitals, a military cadet-school, a workhouse, and a Hungarian theatre.

Being situated in a fertile country at the conflux of two rivers, possessing considerable revenues, and a territory of

its own, 220 square miles in extent, Szegedin should long since have drawn to itself the trade not only of Hungary, but of Transylvania and Turkey; and this the more easily as the two latter countries are nearer to it than to Pesth, and it has greater facilities for communicating with the two circles of the Theiss. Its trade is however considerable and profitable, the chief articles of which are salt (300 vessels loaded with salt come annually from Transylvania), tobacco, of which 60,000 cwt. are sent every year to Hungary, corn from the Banat, timber and wooden wares from Transylvania, horned cattle, hops, and wool. There is a very great manufactory of snuff, the tobacco for which is grown in the vicinity; a soda manufactory, and some considerable soap manufactories, which furnish a kind of soap which is in great repute. Above 40,000 cwt. of cotton from Turkey pass annually through the town to Pesth and Vienna. The wine made in the neighbourhood is good, but will not keep above a year.

Szegedin is a very old place, and in the time of Matthias Corvinus it was one of the most celebrated cities in the whole kingdom. It was taken by the Turks under Soliman II. after the battle of Mohacs, August 26, 1526, in which king Lewis II., 2 archbishops, 6 bishops, 28 magnates of the highest rank, and a great number of nobles of distinction lost their lives. It remained in the possession of the Turks till 1686, when it was retaken by the Austrians soon after the defeat of the Turkish army by Sobieski under the walls of Vienna. In the following year, 1687, the Turks were again totally defeated by the duke of Lorraine on the same battle-field of Mohacs.

(Thiele, *Das Königreich Ungarn*; Blumenbach, *Die Oesterreichische Monarchie*; *Ungarn, Sclavonien, und Croatien*, Anonymous.)

INDEX TO THE LETTER S.

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T.

T is the thin (tenuis) letter of the dental or palato-dental series. For the various forms of the symbol by which it is represented, see Alphabet. The chief changes to which the letter is liable are as follows:—

T is interchangeable with *c*, as Lat. *nuc (nux)*, Eng. *nut*. [See C (§ 6).] The resemblance of these letters in Latin manuscripts is so close, that it is often difficult to distinguish them. Hence there is much uncertainty in the orthography of many words in that language. Yet there is no doubt that *contio*, an abbreviation of *conventio* (*coventio*, in the sense of *contio*, actually occurs in the so-called Bacchanalian inscription), and *nuntius* or *nountios*, an abbreviation of *nov-ven-tius* (compare *nov-i-tius*), should be preferred to the forms *concio*, *nuncius*, which are commonly found in English editions of Latin authors.

T interchangeable with *d*. [See D.]

T interchangeable with *th*, whether as pronounced in *thin* or in *the*. Thus the Latin *t* corresponds for the most part to *th* in English, as *tu*, *tres*, *tenuis*, *tundo*, *tum*, *trudo*, *torqueo*, *pater*, *mater*, of the former language, severally correspond to *thou*, *three*, *thin*, *thump*, *then*, *thrust*, *throw*, *father*, *mother*, of the latter. As regards the pair of words, *torqueo*, *throw*, it is worth observing that they both have a double meaning, *hurl* and *twist*. Even the termination of the third person in the Latin and old English verbs presents the same analogy, as *amat*, *loveth*.

T, or PT, interchangeable with *p*. [See P (§ 7, 8).]

T interchangeable with *s*. [See S.]

T interchangeable with *st*. This interchange might be inferred from the one preceding. Examples exist in *art*, *wilt*, *shalt*, compared with the usual termination of the English second person.

T interchangeable with *l*. Thus the Latin words *lingua* (also *dingua*), *lacr-uma* (also *dacr-uma*), *lacerare*, *ligare* (also *dicare*), severally appear in English as *tongue*, *tear* (subst.), *tear* (verb), *tie*. Hence ἕτερος is allied to the Latin *alter*, and *mitis* of the Latin to *mild* in English. Compare also the Latin *ali-quod*, &c. with the German *et-was*, &c. [See L.]

T interchangeable with *nd*. This change is perhaps not common. Examples are, Lat. *et*, Germ. *und*, Eng. *and*; Lat. *sed* or *set*, Germ. *sond-ern*, Eng. *sund-er*, *sund-ry*, &c.; Greek ἕτερος, German *ander*, Lat. *fund-us*, Eng. *bot-tom*.

T disappears from the beginning of words before *l*, as in *latus*, the so-called participle of *fero*, but in fact connected with the Latin *tollo*, and the Greek τλη-μι, ταλ-ας, τολ-μη. An older form of *latus* was perhaps *tlatus* or *stlatus*.

T in the middle of words, when flanked by vowels, often disappears. Thus the Latin words *pater*, *satis*, *vita*, *amatus*, *amata*, reappear in French as *père*, *sez* (in the compound *as-sez*, from *ad-satis*), *vie*, *aimé*, *aimée*. Similarly, from the map of Gallia, viewed in connection with the map of France, may be derived the examples,—*Autura*, *Eure*; *Caturiges*, *Chorges*; *Catalauni*, *Châlons* (sur Marne).

T at the end of words is frequently dropped. Of the omission of a final *t* in pronunciation, the French language has numerous examples, as in *et*, *fait*, *est*, &c. It is very probable that a final *t* has in this way disappeared from the third person singular of many tenses in the French verb, as *il aime*, *il aimera*, *qu'il finisse*, &c. In the interrogative form *aime-t-il*, the interposed *t* really belongs to the verb, and owes its preservation in this form to the fact that a vowel follows. It is an error to attribute the insertion of the letter to the necessity of avoiding an hiatus. Even the Greek language drops this *t* in the suffix of the third person, as in τυπτει, ετυπτε, for τυπτετι, ετυπτετε. Compare the middle forms τυπτεται, ετυπτετο.

Ti before a vowel is often changed to a sibilant represented by *s*, *sh*, *ch*, &c. Thus from the Latin *faction* (*factio*) are derived the French *façon* and the English *fashion*. So *avaritia*, *malitia*, *vitium*, became in French and English *avarice*, *malice*, *vice*.

TAASING. [Denmark; Fünen.]

TAB. [Persian Gulf.]

TABARCA, TA'BRACA, or THA'BRACA, a small island close by the north coast of Africa. It is situated opposite the north-eastern corner of Numidia, at the mouth of the little river Tusca, on the left bank of which there was an antient town of the same name as the island, which Pliny (*Hist. Nat.*, v. 2; compare Ptolemaeus, iv. 3; Pomp. Mela, i. 7, 5) calls an 'oppidum civium Romanorum.' Of this town many ruins are still scattered on the bank of the river, which is now called Zaine. (Shaw's *Travels*, p. 99.) The little island of Tabarca has in modern times been in the possession of the Genoese, who once derived considerable advantage from the coral fisheries there, and built a fort upon it to protect their settlement. But when the profits of the coral fishery decreased, the Genoese left the island to the dey of Tunis. (Shaw's *Travels*, p. 142.) The island is at present in the possession of the French, to whom it was given up in 1830 by the dey of Tunis. The harbour is now again much frequented by fishermen, on account of the rich coral fisheries in the neighbourhood.

TA'BARI' is the surname of Abú Jaafar Mohammed Ibn Yezid Ibn Jerir, a celebrated Arabian historian, who was called At-tabari because he was a native of Amol, the capital of Tabaristán, where he was born in A.H. 224 (A.D. 839). Tabari was the author of many works on various subjects, such as a commentary on the Korán, which is greatly praised by Abu-l-fedá (*Ann. Musl.*, iii.), and a treatise on Mohammedan law. But the work by which he is best known in Europe is his general history from the creation to A.H. 302 (A.D. 314-5). This work was abridged and continued by George, son of Al-'amid, generally called Elmacin, who brought it down to the year 512 of the Hijra (A.D. 1118-9). That portion of the abridgement which begins at the death of the Mohammedan prophet was published in Arabic and Latin by Thomas Erpenius, and printed for the first time at Leyden, 1625, fol., together with the 'Historia Arabum,' by Rodericus Toletanus. Tabari's Chronicles were translated into Persian by Abú Ali Abdu-l-ghani, Vizir of the Samanide prince Mansúr Ibn Núh. Soon after the death of Tabari, the copies of his original work became so scarce, that the Persian text was retranslated into Arabic; the Persian version is now being translated into French by Mr. Dubeux under the auspices and at the expense of the Oriental Translation Fund. Tabari died at Bagdad, in A.H. 310 (A.D. 922).

(Hamacker, 'Spec. MSS. Orient.,' *Bib. Lugd.-Bat.*, p. 21; D'Herbelot, *Bib. Or.*, sub voc. 'Thabari.')

TABARIEH. [Palestine, p. 163; Syria, p. 472.]

TABASCO. [Mexican States.]

TABERG. [Sweden.]

TABERNACLE, THE (אֹהֶל מוֹעֵד, and sometimes, chiefly in *Numbers*, אֹהֶל הָעֵדוּת, or מִשְׁכַּן הָעֵדוּת: LXX., σκηνή, or σκήνωμα τοῦ μαρτυρίου; that is, the tabernacle of the testimony), was a sacred building, partaking of the nature of a tent, which was set up by the Israelites in the wilderness for the worship of God, and carried with them in their journeys. Hence it is called by Jewish writers 'a portable temple' (ἱερὸν φορητὸν, Philo, *Opp.*, ii., p. 146, ναὸς μεταφερόμενος καὶ συμπερινοστῶν; Joseph., *Antiq.*, iii. 6, 1). It was made under the direction of Moses, in exact conformity to a pattern shown to him by God when on Mount Sinai. (*Exod.*, xxv. 40; xxvi. 30, &c.; *Heb.*, viii. 5.)

The tabernacle was an oblong rectangle, 30 cubits in length, 10 in width, and 10 in height. Its two longer sides looked north and south, the entrance being at the east end. The sides and the west end were composed of boards of shittim (acacia) wood, overlaid with gold. These boards stood upright, and were supported by tenons projecting from their lower ends, which dropped into sockets of silver, each board having two sockets. Each board was 10 cubits long, and 1½ wide; and there were 20 boards to each side, and 8 to the end. Here arises a difficulty. The 8 boards at the end make up 12 cubits, instead of 10. Now it is clear from *Exod.*, xxvi. 22-24, that the two boards at the corners were of a different form

from the other six, and in fact their form is described in that passage, but the description is not quite easy to understand. The most natural explanation seems to be that each of the corner boards was divided into two parts, one of a cubit and the other of half a cubit in breadth, that these two parts were then fastened to each other at right angles, and that they were so placed in the building that the half-cubit formed part of the west end, while the whole cubit stood face to face with the first board of the side, to which it was in some way fastened (*Exod.*, xxvi. 24), thus making the corners of the building firm. The boards were still further supported by bars of acacia-wood overlaid with gold, which were passed horizontally through rings fastened to the boards. Of these bars there were five to each side and five to the end.

The east end, at which was the entrance, was covered by a curtain of fine linen, ornamented with needle-work in blue, crimson, and scarlet, and supported by five pillars of acacia-wood, overlaid with gold, furnished with golden hooks, and standing on brass sockets, one socket to each pillar. Across the interior of the tabernacle, at the distance of two-thirds of its length from the entrance, was another vail, of exactly similar work and materials, supported by four pillars like those at the entrance, but with silver sockets. This vail divided the tabernacle into two chambers, which were respectively 20 feet by 10, and 10 feet by 10, of which the outer and larger was called the Holy Place (הַקֹּדֶשׁ), the inner the Most Holy, or the Holy of Holies (קֹדֶשׁ קָדָשִׁים; LXX., *τὸ ἅγιον τῶν ἁγίων*; Joseph., *τὸ ἄδυτον*).

The structure thus formed (which was still open at the top) was covered by four different kinds of curtains. The first covering was of the same materials as the two vails, and consisted of 10 curtains, each 28 cubits long and 4 wide, which were first joined together five and five, thus forming two curtains, each 28 cubits by 20, and then these two curtains were coupled together at the longer edges by golden fastenings, and laid over the tabernacle so that the fastening lay over the inner vail; the one curtain reached exactly to the entrance, without falling over it, thus covering the Holy Place and the other covered the Holy of Holies with half its length (10 feet), leaving 10 feet to hang over the back of the tabernacle, while the remainder of the curtains fell over the sides (according to the opinion of some, *within* them), leaving one cubit at the lower end of the boards uncovered, since the heights of both sides, and the width of the building, make up 30 cubits, but the width of the curtains was only 28. The next covering was of fine spun goats'-hair, and resembling the former in every respect except that it was somewhat larger. Over these coverings, to protect them from the weather, were two more, the first being of sheep-skins dyed red, and the outer of skins of *tachash* (תַּחַשׁ), a word which is variously explained as meaning the badger, the seal, or a blue colour.

The tabernacle was surrounded by a large court, called 'the court of the tabernacle,' which formed a rectangle of 100 cubits by 50, and was enclosed by fine linen hangings, suspended on 60 pillars of 5 cubits in height, with silver capitals and hooks, and brass sockets. The four pillars in the middle of the eastern side supported a curtain like the vails of the tabernacle, which formed the gate of the court. Around this court were the tents of the tribe of Levi, and then at a greater distance the encampments of the other tribes, three tribes on each side of the tabernacle.

Each of the sacred vessels and instruments had its appointed place in the tabernacle. Near the entrance of the outer court was the brazen altar of burnt offering, on which were presented all the burnt offerings and sin offerings which were not required to be offered without the camp. Further on was the brazen laver, where the priests were required to wash their hands and feet before they entered into the tabernacle.

Within the Holy Place was the golden table of shew-bread on the north side, and the golden candlestick on the south side, and the golden altar of incense, with their instruments. In the Most Holy Place was the ark of the covenant, with its cover, the mercy-seat, the symbol of Jehovah's throne.

None but the priests were allowed to go into the tabernacle. They entered it twice a day; in the morning to put out the lights, and in the evening to light them; and also on the Sabbath to place the new shew-bread. The Holy of Holies was entered by the high-priest alone, and by him only once a year, on the great day of atonement. Of course there was a necessary exception to these rules when the tabernacle had to be taken down or set up. The care of this service and of carrying the sacred things on the march was committed to the families of the Gershonites, the Merarites, and the Kohathites, of the tribe of Levi.

The tabernacle was first set up by Moses on the first day of the first month of the second year from the Exodus, when the presence of God was manifested by the shekinah, which filled the tabernacle. Whenever the camp was at rest, the shekinah was over the tabernacle, as a cloud by day and a fire by night. The lifting up of the shekinah was the divine signal for the people to march; and when it again rested in any spot, there the tabernacle was set up, and the camp was formed around it. After the conquest of Palestine the tabernacle was set up in Shiloh, where it remained, with the ark of the covenant in it, till the latter was carried out to battle and taken by the Philistines just before the death of Eli. (1 *Sam.*, iv. 16-21.) After seven months the Philistines, moved by the judgments of God, restored the ark, which however was not brought back to Shiloh, but to Kirjathjearim (1 *Sam.*, vii. 1-2), where it remained till David brought it to the city of David in Jerusalem, and pitched a tent for its reception (1 *Chron.*, xiii.-xvi.), where it remained, with a short interruption during the rebellion of Absalom, till it was placed in the Holy of Holies of Solomon's temple. (2 *Chron.*, v.)

We have not such exact information respecting the history of the tabernacle during this period. By comparing 1 *Sam.*, xxi., with *Mark*, ii. 26, we learn that it was at Nob in the time of Saul. At the beginning of Solomon's reign it was at Gibeon (1 *Kings*, iii.), whence it was taken by Solomon, and laid up in the Temple, at the time when he removed the ark. (2 *Chron.*, v.)

The institution of the tabernacle was in perfect accordance with the spirit of the Israelitish constitution. God was the king of Israel; he had promised to be with them, and to go with them in their journeys; and the tabernacle was his abode. Here the glory which was the symbol of his presence was displayed, and hither the people came to worship him and to inquire his will, while his chosen servants (the priests) attended constantly upon him. (*Ps.*, lxxxiv. 4-7.) When Israel was firmly settled in the promised land, and a special place was fixed on for the display of God's presence, the moveable tabernacle was superseded by the permanent temple. The New Testament assigns to the tabernacle a higher meaning, as typical of the blessings of the Gospel. (1 *Heb.*, ix.)

(Winer's *Biblisches Realwörterbuch*, art. 'Stiftshütte;' Calmet's *Dictionary*, s. v.; Jahn's *Biblical Antiquities*: *The Tabernacle in the Wilderness*, 1 vol. fol., with four splendidly illuminated plates, Bagster, 1812.)

TABERNACLES, FEAST OF (חַג הַסֻּכּוֹת. *ἑορτὴ σκηνῶν, σκηνοπηγία*), was the last of the three great annual festivals of the Israelites, which required the presence of all the people in Jerusalem (*Exod.*, xxiii. 16; *Levit.*, xxiii. 34; *Numb.*, xxix. 12; *Deut.*, xvi. 13). Its object was to commemorate the dwelling of the people in tents during their journeys in the wilderness; and it was also a feast of thanksgiving for the harvest and vintage, whence it is called 'the feast of ingathering.' It was celebrated in the autumn, at the conclusion of the vintage, and lasted eight days, namely, from the 15th to the 23rd of the seventh month (Tisri, which corresponds to October). The first and last days were holy convocations, in which no work might be done, and the last was the greatest day of all the feast (*John*, vii. 27). In the opinion of many biblical antiquarians, the feast of tabernacles properly lasted only for seven days, the eighth being peculiarly 'the feast of ingathering.' (*Nehem.*, viii. 18.)

This feast lasted longer than either of the other great feasts: it was kept with greater demonstrations of joy, and more sacrifices were offered during its continuance. (*Levit.*, xxix. 12-38.)

During the feast the people dwelt in booths, which were

made on the tops of their houses (*Nehem.*, viii. 16). These booths were made of the leafy branches of certain trees, which are mentioned in *Levit.*, xxiii. 40, and *Nehem.*, viii. 15, and among which seem to be included the citron, the palm, the olive, the myrtle, and the willow. These booths were meant to represent the tents in which the Israelites dwelt in the wilderness. In the sabbatical year, the law was read in the presence of all the people at this feast. (*Deut.*, xxxi. 10-13; *Nehem.*, viii.)

Like many others of the institutions of the Mosaic law, the feast of tabernacles was neglected during the period from the settlement of Israel in Palestine to the Captivity. It was revived in the time of Ezra and Nehemiah. (*Nehem.*, viii.)

Plutarch (*Sympos.*, iv. 6) gives an account of the feast of tabernacles, which he supposed to be in honour of Bacchus.

The later Jews have added other ceremonies to those which are assigned to this feast in the law. 1. They carry a citron in the left hand, and a bundle of branches, namely, one of the palm-tree and two of the willow and myrtle, in the right, with which they walk in procession round the reading-desks in the synagogues, singing Hosannahs. This ceremony, which is repeated seven times on the seventh day, is said to be in commemoration of the taking of Jericho by such a repeated procession round its walls. (*Joshua*, vi.) On each of the seven days of the feast they pour out a libation of water. They assert that this was done anciently before the altar at Jerusalem, with water brought from Siloa. 3. They assert that lights were burnt in the court of the women on the first evening of the feast. These lights were in large golden candlesticks, and their brightness was visible over all the city.

(Winer's *Biblisches Realwörterbuch*, art. 'Laubhüttenfest;' Jahn's *Biblical Antiquities*; Jennings's *Jewish Antiquities*.)

TABERNÆMONTA'NA, a genus of the natural family Apocyneæ, found in the West Indies and South America, also in New Holland, India, and other tropical parts of Asia. It was named by Plumier in honour of James Theodore, who was surnamed Tabernæmontanus, from Berg-Zabern, the place where he was born. He was author of two works, his 'Kraüterbuch,' and 'Figures of Plants.' The first, published in 1589, and the second in 1590. He was also physician to the elector-palatine, and died in 1590. The genus is characterised by having monopetalous inferior flowers. Corol salver-shaped. Stamens 5, included. Anthers sagittate. Ovaries 2. Style filiform. Stigma dilated at base, trifid. Seeds in a follicle, immersed in pulp. The flowers of many species are very sweet-scented, and the double-flowered variety of T. coronaria is a very ornamental shrub, and one of the most common in Indian gardens. The deep red pulp surrounding the seeds of this species appears capable of yielding a beautiful colour. The cream-like sap of T. utilis, the milk-tree, or Hya-hya of Demerara, is not only of an innoxious character, but said to be very nourishing. It affords a remarkable example of a tree of this suspected family yielding an article of food. Some of the other species are employed as medicines in the countries where they are indigenous. The sap of T. persicariæfolia is considered a poison in the Isle of France. The wood is employed in turnery.

TABERNÆMONTANUS, JACO'BUS THEODO'RUS, a physician and botanist, was born at Berg-Zabern in Alsace, whence he takes his name. He first practised as an apothecary in his native place, and thence removed to Paris, where he graduated. On returning to his native country, he took up his residence and practised his profession at Worms. He was made physician to the elector-palatine John Casimir, and also to the bishop of Spire. He lived at a time when confidence in vegetable remedies in disease was carried to the greatest extent. He diligently studied this department of his profession, and the result of his labours was given to the world in the form of a large folio volume, under the title 'Neue Vollkommen Kraüterbuch,' or new complete herbal. He lived to see only the first part of this volume published, which was in 1588. Several editions of this work were afterwards published in Germany, to which the two last parts were added. The second edition was published at Frankfort in 1613, by Caspar Bauhin, and contained descriptions of 5800 species of plants, of which 2480 were illustrated by wood-engravings. The best and latest edition published is that of Hieronymus Bauhin, which appeared at Basle in 1731. This work appears to have been for a long time a standard botanical authority. The descriptions of the plants are minute, and an immense space is devoted to the consideration of their medical properties. Tabernæmontanus maintained the principle, which has many advocates at the present day, that Providence causes those plants to grow in a district which are beneficial for the diseases that arise in it. To such an extent did he carry his views on this point, that it is said that at the siege of Metz, in 1552, in which he was engaged as physician to the army, he applied nothing but mugwort to the wounds of the soldiers, because it grows plentifully in the neighbourhood. The cuts in the work are badly executed, and are mostly inferior copies from preceding works. This however did not prevent their being republished without the letter-press, by Nicolas Bass, the printer at Frankfort, in 1590, under the title 'Icones Plantarum.' &c. In the latter part of his life, Tabernæmontanus removed to Heidelberg, where he died in 1590. He also published two other works: the first, on mineral waters, entitled 'Neue Wasserschatz,' in 1584, and which went through three editions; the second was published in 1586, and is entitled 'Regiment und Bericht wie man sich in Sterbenslaufen halten soll.'

TABES. This word belongs to a period in the history of medicine, when nosologists were less informed than they now are of the true nature of many diseases; and, instead of classifying these according to their essential characters in reference to the single standard of healthy function, selected and arranged such signs and appearances only as were sensibly manifest to the observer, or were described by the patient. The nomenclature founded on this arrangement consisted in naming by uninterpreted symptoms: it involved many breaches of natural affinity, and gave great opportunity for empirical practice. Thus a cough, a dropsy, a palpitation of the heart, would be spoken of as individual diseases: whereas they may on the one hand be joint symptoms of a single malady (as imperfect valvular action of the heart); or, on the other hand, taken singly each would be but a sign, common to many disorders, which might have no other feature of resemblance, and might require even opposite treatment. Such a name is 'tabes,' and under it are isolated certain symptoms, afforded by the nutritive functions in various conditions of unhealth: the acceptation of the word being a 'cachexia (or state of chronic ill-health) attended by emaciation;' in which sense it is synonymous with the words 'atrophy' and 'marasmus.'

Emaciation belongs, as a symptom, more or less to two-thirds of the diseases which terminate life, and essentially denotes an unfavourable disturbance of the healthy equilibrium between supply and expenditure in the animal economy. Mere leanness, or scarcity of fat (the opposite condition to obesity), is not a sign of disease: in many it exists through life, as an inherited physiognomical character; and in most it prevails during those periods, at which the vital powers are most active: it characterises those individuals in whom, and that period of their existence in which, the reproductive function is most efficient, the muscular system most powerful, the respiration most complete, the feelings most excitable, and the intellect keenest. It stamps, in a word, the characters of energy and excitability on its subject, and it is usually only in the absence of these qualities that obesity prevails. Now, as obesity indicates that nature has accumulated the surplus materials of nourishment, in a form which admits of their subsequent appropriation to the needs of the economy (a provision, familiarly known in hybernating animals, and to which the secretion of starch in the vegetable kingdom is analogous); so does emaciation, or loss of flesh, declare that the system is either drained or ill-fed, and is repairing its deficiency at the expense of particular organs. 1. This state may arise from a deficient supply of material for organic nutrition, either where the food is, in quality or quantity, insufficient; or where the digestive canal is unable to appropriate it; or where (as in the disease which is the subject of the next article) its due absorption into the blood is hindered. 2. It may occur from too profuse or too partial expenditure on the part of the organization, as where protracted diarrhœa, or the discharge from large ulcerated surfaces, exhausts the

material of nourishment; or where a sustained intensity of mental excitement or of bodily fatigue deranges its balance. From this account of emaciation it is obvious that it must accompany very different chronic disorders, which have been confounded in the unscientific word 'tabes;' and from the marked falling away which attends pulmonary consumption [PHTHISIS PULMONALIS], it is probable that many cases of this destructive complaint have been so miscalled. The name is now retained for only two forms of disease, and derives its special meaning from the accompanying adjective.

Tabes mesenterica is that wasting of the body which follows scrofulous inflammation of the mesenteric glands; and *Tabes dorsalis* denotes an impairment of general health, attended by emaciation, muscular debility, and signs of nervous exhaustion, in persons who have given inordinate licence to the sexual appetite.

The treatment of the emaciation and debility which constitute the symptomatic state called 'tabes,' must be adapted to remedy the primary disease. If exhaustive discharges exist, measures must be taken to arrest them, and will vary according as the drain from the system is maintained by diarrhœa, hæmorrhage, or suppuration. If absence of healthy food, or inability of the digestive organs to appropriate nourishment, have caused the emaciation, nutritious diet with careful regard to the intestinal complaint must be adopted. In all cases the main object of the practitioner is to effect a removal of the noxious influence which has deteriorated the health; and success in this particular, followed by such tonic treatment as may be called for, will re-establish the natural balance of healthy nutrition.

TABES MESENTERICA. This name is applied to a particular slowly-disorganizing affection of the mesenteric glands, and expresses the marked emaciation which attends the disease. It is through the mesenteric glands that the nutritive products of digestion are transmitted in their course to the great current of the circulation; and any disorder which destroys or obstructs these organs must, in proportion to its intensity, affect their function, and derange the process by which healthy materials of renovation should constantly be commingled with the blood. Hence in part arises the loss of flesh in this form of tabes; but the direct hindrance of nutrition which the disease involves is not the sole though an important cause of the symptom; for the general ill-health, of which tabes mesenterica is but a part, and other co-existing complaints, usually co-operate in producing it.

The disease is one among many manifestations of scrofula; and to the glands of the mesentery is essentially the same as those obstinate glandular enlargements of the neck, with which the eye is more familiar, are to their region of the body. From difference of position and of relations it includes other symptoms and graver consequences than theirs; but it originates in the same constitutional tendencies, and follows the same general progress, as they. It belongs, like other forms of scrofula, to early life; the ordinary period of its invasion being from the second to the twelfth year. In the Hôpital des Enfans, of Paris, children are received from a year after birth till the completion of sixteen years of age; and M. Guersent, the physician of this institution, states that the disease exists among those admitted in the proportion of 7 or 8 to 100; and that it is more frequent among female children than among males.

The morbid appearances on dissection of fatal cases are, a more or less complete transformation of the glands into tubercular masses, with various consequent or coincident diseases of the adjoining organs. The glands appear at the commencement of the complaint to be the seat of a feeble inflammatory action, under which they merely swell and become preternaturally reddened with blood: but this stage of simple congestion soon induces a further change, in which the characteristic product of scrofulous inflammations becomes deposited in the tissue of the gland. The dull white granular tubercles, by which the infiltration commences, are gradually multiplied in number or increased in volume; and, in like proportion, the glandular substance itself is absorbed to make room for the encroaching disease, till at length a rounded tubercular mass results, varying for each tumour from the size of a marble to that of an egg. In a still more advanced condition of the disease suppuration frequently occurs in these tumors, and they are then seen to contain the cheese-like matter of softened tubercle mixed with pus. The abscess so formed excites irritation in its neighbourhood; the folds of peritoneum covering it become glued together, and its progress occasionally extends to discharging itself into the nearest intestine, or through the external integument of the abdomen. A certain amount of inflammation of the peritoneum, with adhesions and effusion of serum (ascites), attends these latter stages; and some inflammation and ulceration of the mucous membrane of the intestines are likewise frequently found.

For a particular account of its causes the reader may refer to those of SCROFULA. Original weakness of constitution, shown in general susceptibility to the impressions of disease, in slowness and insufficiency of reactive and reparative power, is the groundwork of these, and constitutes the main peculiarity of the so-called *scrofulous diathesis*. But this weakness may, where inborn, be aggravated, or, where naturally absent, be artificially produced by a variety of depressing causes; by insufficient or unhealthy food, by neglect of cleanliness and exercise and clothing, by residence or constant occupation in ill-ventilated buildings, by exposure to cold and damp: all of them influences to which the young of the poor in crowded towns are exposed, and with which too frequently an inherited predisposition powerfully co-operates. Derangement of the bowels must be considered the most frequent special cause of this particular form of scrofula; the irritations, inflammations, and ulcerations of their mucous surface (of which such full evidence is given in the state of the tongue and excretions, and in the tympanitic abdomen) excite corresponding conditions in the absorbent glands connected with them (precisely as a lesion of the hand irritates the glands of the axilla), and the inflammation so beginning takes a course determined by the peculiar constitution of its subject.

As regards symptoms, it may be observed that in its earliest stages the disease has no signs by which it may be certainly distinguished; that it is not till the glands are so enlarged as to become sensible externally that their affection can be positively declared. The early symptoms are those of the intestinal disorder or irritation, which is acting as a cause of the disease: capricious appetite, irregular and unhealthy stools, flatulence or occasional vomiting, loaded tongue, foul breath, harsh skin, sallow complexion, and loss of flesh, with an accelerated pulse, may have existed for some time, before enlargement of the abdomen attracts notice. It will then usually be found that steady pressure on this part causes uneasiness or pain. As the growth of the glandular tumors continues, the signs of intestinal disease become more marked; diarrhœa with mucous stools, increased emaciation, frequent pulse, and evening accession of fever, marking this stage, in which the tumid abdomen contrasts remarkably with the wasted limbs and shrunken wan face of the patient. Finally, hectic fever with exhaustive diarrhœa, or acute abdominal inflammation, or the progress of the constitutional disease in other organs, or absolute starvation (atrophia), terminates life.

The treatment of tabes mesenterica must be in accordance with the general rules for management of scrofula, and consists in that modified tonic system, to which the name of 'alterative' is given. To maintain a healthy state of the secretions, and to fortify the general health, compose this plan of treatment; and the modes of fulfilling the indications may be thus briefly detailed: cleanliness, warm clothing, and suitable exercise will promote the action of the skin; small quantities of castor-oil will regulate the evacuations from the bowels, if these be sluggish, and occasional mild mercurials, with rhubarb and alkalies, improve the character of the intestinal secretions: residence in a dry mild climate, or by the sea-side, a light but nutritious diet, carefully adapted to the varying whims of the appetite, and, where it can be borne without producing feverishness, some vegetable bitter (as calumba or cascarilla) will prove most successful in supporting or improving the general strength. Where there is no abdominal tenderness, and where the secretions have been brought into a healthy state, gentle friction of the abdomen with some stimulating liniment may be conjoined with other means; but this is quite inadmissible in the latter stages of the complaint, or where tenderness of the abdomen prevails. Within the same limitations, iodine is

sometimes of service, and may be used both by inunction and by internal administration; but its effects require to be most carefully watched, and its employment must be suspended if it increase fever, or cause any irritation of the stomach or bowels.

The treatment here sketched will, in the commencement of the disease, often prove successful in effecting the removal of the tumour and restoring the patient to health; but in the more advanced state the physician can have little hope to do more than restrain the urgent diarrhœa by occasional opiates, and retard death by a carefully-regulated and nutritious diet.

TABLATURE, in Music, is the old mode of notation for instruments of the lute kind. For this purpose six parallel lines were used, each representing a string, on which were placed letters referring to the frets on the neck of the instrument. The time, or duration, of the notes was marked by characters over the letters, answering to the minim, crotchet, &c., and often, as by Mace, in his *Musick's Monument*, by the notes themselves. There were different systems of Tablature; but the subject is not now worth the trouble which a knowledge of it would demand.

TABLE BAY. [CAPE OF GOOD HOPE.]

TABLE. By a table is meant a quantity of information arranged under heads in such manner that by looking under one head the general disposition of the whole points out where to look for the matters of information connected with that head: the object being an immediate power of reference to any one fact or result without the necessity of looking at others. In any astronomical table, the matter by which we enter the table to look for other matter is called the *argument*; that which is found by means of the argument has no distinct name; we might call it the *tabular result*. It would be useful to generalize these terms. Thus in a table of contents, the number of the page or chapter is the argument, and the abstract of the matter contained is the tabular result: in an alphabetical index the principal word, found by means of its first letter, is the argument; and the number of the page in which the matter is contained is the tabular result. It is, unfortunately, useless to say much on any tables except mathematical ones. Works containing collections of facts, in which the tabular form ought to be frequently used, are in most instances altogether free from them; and as to indexes, the art of making them seems to be lost: very few books, except those on law, have anything deserving the name. The reason is obvious enough: where proper information is not given, the table shows the spot where it ought to be, *vacant;* and a good index points out not only what *is* in the work, but also that which *is not*.

When the matter sought for is found by one argument only, the table is said to be of single entry; when by two, of *double entry*. Thus the common multiplication table is one of double entry; and so is any chronological table which consists of more than one column.

The method of printing mathematical tables is usually defined so closely by the nature of the subject, that no remark is necessary except on the type. The numeral characters, up to about the year 1785, used to be smaller in the body than those now constructed, with distinguishing heads and tails. Dr. Hutton, we believe, first employed the character in which all the numerals are of the same depth, the heads or tails being compressed into the body. This very disadvantageous change was adopted by the type-founders, but only in England: the consequence was that the superior legibility of the antient and of the modern continental tables was matter of common remark among those who had to use them. Another circumstance which contributed to this result was the introduction of numerals with thick and thin parts, the superior elegance of which was supposed to be a recommendation. The consequence was, that in many English tables it was difficult to distinguish 3 from 8, and 9 or 6 from 0. Of late years however some works* have been published which have used the old type, both as to heads and tails and uniform thickness; and their decided superiority over tables of the Huttonian character, even of much larger type, is pretty generally admitted. This is a point of great importance: for any circumstance which produces a wrong result upon the computer's paper is equally to be deprecated, whether it be an error in the formula used by the author of the tables, or an incorrectness of the printer or reviser; and in like manner a given amount of tendency to error is of the same bad consequence, whether it be due to the mathematician or the type-founder. This is not true of works of theory or reasoning: it may there be the fault of the reader if he do not correct a mere slip, whether of the author or printer; but in works of reference all the parties to the result are of equal importance.

Since the invention of logarithms, the appetite for tables has not grown with the progress of mathematics. Calculation by logarithms is so convenient for ordinary purposes, that many persons who are even well versed in mathematics are not aware how much assistance they might derive in particular cases from the various tables which have been published. The list which we mean to give does not profess to be a bibliography of tables, but will nevertheless give information on the subject to all who are not particularly given to mathematical bibliography.

We may divide mathematical tables into general and special; the first consisting of purely arithmetical and trigonometrical tables, and also tables of logarithms. The special tables are those which are used in the higher parts of mathematics, in commerce, navigation, astronomy, meteorology, &c. We may further divide tables into tables of facts and tables of mathematical results. All sciences have their tables of facts; thus the raw observations of astronomy, magnetism, and physics in general are frequently tabulated: with these we have comparatively little to do, since they are rather the materials for the formation or verification of other tables, than of primary use as tables.

Of simple arithmetical tables we may notice the following:—

§ 1. *Tables of Multiplication.*—The oldest we have seen noticed is one printed in 1610, at Münich (Muhard). There have been several others of great extent, but they are scarce. Hutton's 'Tables of Products,' printed by the Board of Longitude, 1781, go up to 100 times 1000, but have not the reputation of correctness. Riley's 'Tables of Products,' published anonymously, London, 1775, contain the first nine multiples of all numbers up to 10,000, in a very clear figure, and are useful. Dodson's 'Calculator,' London, 1747, has the same up to 1000, not so conveniently arranged. But by far the most powerful table of this kind is Crelle's 'Rechentafeln,' Berlin, 1820, in two thick 8vo. volumes. This contains every product up to 1000 times 1000, so arranged that all the multiples of one number are seen at the same opening of the book. All who have used this table know how to dispense with logarithms in many cases with great advantage. There is no table which we so much desire to see reprinted in this country, with a few alterations, which would render it more commodious. An anonymous Table, Paris, 1794, goes up to 1000 × 103; and another, Paris, An VII., the same; a third, Versailles, 1825, the same, with many metrological tables added. Schubler's 'Rechnung's Lexicon,' Nuremberg, 1739, goes to 2400 × 100. Oyon's Table, Paris, 1824, goes to 509 × 500; that of Cadet, Paris, 1797, to 1000 × 100. [QUARTER SQUARES.]

§ 2. *Tables of Division and of Prime Numbers.*—Gruson, 'Pinacothèque,' Berlin, 1798, gives for all numbers under 100, or primes under 400, the quotient and remainder of every number under ten times the divisor, by inspection: also, divisors without remainders, up to 10,500. Lidonne, 'Tables de tous le Diviseurs,' &c., Paris, 1808, gives the divisor of all numbers up to 102,000. The original edition of Barlow's Tables gives the factors of all numbers up to 10,000, and a register of prime numbers up to 100,103. Chernac, 'Cribrum Arithmeticum,' &c., Daventriæ, 1811, gives the prime numbers up to 1,020,000, and the lowest divisor when not 2, 3, or 5. Burckhardt, 'Table des Diviseurs,' &c., Paris, 1817, gives the prime numbers up to 3,036,000, with the lowest divisor of each number when not either 2, 3, or 5. This last is, we believe, the greatest undertaking of the kind. Anjema's 'Tabula Divisorum,' Leyden, 1767, goes up to 10,000; and Pigri's Table, Pisa, 1758, the same. Krause, Jena and Leipsic, 1804, has

* In the new series of the Nautical Almanac, the heads and tails first reappeared, but the swelling of the type was not rejected. The works in which the old legibility is completely restored are, as far as we know, the tables of logarithms (four and five figures), and the reprint of Barlow's Tables (Taylor and Walton), the six-figure logarithms (Longman), and Lieut. Raper's Elements of Navigation.

primes and factors up to 10,000. Newman, 'Tabellen, &c.,' Dessau, 1785, has factors and primes up to 100,100.

Guldinus and Schooten both are said to have given tables of prime numbers, but we have neither found them nor a description of them. Thomas Branker appended to his translation of Rhonius's Algebra a table of primes and divisors for all numbers under a hundred thousand. This was reprinted by Baron Maseres, and was appended to his tract 'On the Doctrine of Permutations and Combinations,' London, 1795; a book very easy to be obtained.

Vega (Octavo logarithms, vol. ii., 1797) gave primes and divisors up to 102,000, and further primes up to 400,000.

§ 3. *Tables of Squares, Cubes, Square Roots, and Cube Roots.* Up to one thousand these are very common; we shall mention these which go higher. The oldest we know of is Maginus, 'Tabula Tetragonica,' Venice, 1592, which gives squares, and, we believe, cubes also, up to those of 10,100. Guldinus, 'De Centro Gravitatis,' Vienna, 1635, gives the squares and cubes up to those of 10,000. Pell, London, 1666 (Murhard), squares to that of 10,000. Ludolf, 'Tetragonometria Tabularia,' Frankfort and Leipsic, 1690, gives the squares up to that of *a hundred thousand:* the largest table of squares in existence, and very little known. J. P. Buchner, 'Tabula Radicum,' &c., Nuremberg, 1701, gives squares and cubes up to those of 10,000. Hutton (table in § 1) gives squares up to that of 25,400, and cubes up to that of 10,000.

Dodson 'Calculator' (§ 1) gave square and cube roots up to those of 180: Hutton afterwards gave the same up to those of 1000 (where first, we do not know). Barlow, 'Tables,' London, 1814, gave squares, cubes, square roots, cube roots, and reciprocals, up to those of 10,000; the interminables to seven decimal places. These were reprinted a little while ago (London, Taylor and Walton, 1840), from the original, after re-examination. Tables of squares and cubes, up to those of 10,000, were reprinted from Séguin's 'Manuel d'Architecture,' with a descriptive preface, at Paris, about the beginning of the century. Meinert's Logarithms, Halle, 1790, contain squares and cubes up to those of 1000. Bochert, 'Tafeln, &c.,' Leipsic, 1812, goes to the square of 25,200, the cube of 1200, and the square and cube root of 1000. Beyens, Ghent, 1827, goes to the square of 10,000, and the cube of 1000. Schierk, 'Tafeln, &c.,' Rohn om Rheim, 1827, has squares up to that of 10,000.

Joncourt, 'De la Nature, &c. de Nombres Trigonaux,' Hague, 1762, gave triangular numbers up to that of 20,000, cubes up to that of 600, and showed how to use the former in the construction of squares and square roots. As to higher powers than the third, Hutton and Barlow, in works above cited, give every power of every number up to the tenth power of 100. Barlow gives also the fourth and fifth powers of numbers from those of 100 to those of 1000.

§ 4. *Pure Decimal Operations.*—Besides Barlow's reciprocals (§ 3), the only remarkable tables of which we know under this head are Goodwyn, 'Table of the Circles arising from the Division of a Unit,' London, 1823, and 'Tabular Series of Decimal Quotients,' London, 1823 (both anonymous). The first gives all the circulating decimals which can arise from any fraction whose denominator is under 1024; the second arranges all fractions which in their lowest terms have a numerator not exceeding 99 and a denominator not exceeding 991, in order of magnitude, and gives their equivalent decimals to eight places. Mr. Goodwyn (of Blackheath) was an indefatigable calculator, and the preceding tables are the only ones of the kind which he published. His manuscripts, an enormous mass of similar calculations, were lately purchased by the Royal Society.

Of pure trigonometrical tables, independently of logarithms, the following are the most remarkable:—

§ 5. Regiomontanus on triangles, Nuremberg, 1533, contains his and Purbach's table of sines. Apian, 'Introductio Geographica,' Ingolstadt, 1533, and again in 'Instrumentum primi mobilis,' Nuremberg, 1534, gave sines. Copernicus (1543) gave one in his book 'De Revolutionibus.' In 1554, Erasmus Reinhold published the first table of tangents. In 1588, the table of secants of Maurolico was published (posthumously). The three are first united in the 'Canon Mathematicus' of Vieta, Paris, 1579, the first trigonometrical tables which resemble the modern ones in arrangement. (A very rare book: Hutton gives a description, from his own copy, in the preface to his tables.) The 'Thesaurus Mathematicus' of Pitiscus, Frankfort, 1613, contains the sines for every ten seconds, to what we should now call 15 places of decimals, and for every second in the first and last degrees; all computed by Rheticus. Pitiscus himself added the first and last 35 minutes, to 22 places of decimals. But a larger work of Rheticus was published by Valentine Otho, the 'Opus Palatinum,' Neustadt, 1596, a complete trigonometrical canon, to every ten seconds, and to ten places of decimals. Lansberg, 'Geometria Triangulorum,' 1591, had given a complete canon for every minute, to seven places. Hutton thinks this is the first in which the three headings are sine, tangent, and secant. The trigonometry of Pitiscus (1599) gave the same. Magini, 'Primum Mobile,' Bologna and Venice, 1609, gave another. Schooten, 'Tabulae Sinuum,' &c., Amsterdam, 1627, is a complete canon to seven places, in a pocket volume with pages of two inches by four. It is often said to contain no error; but we believe the author's own assertion in the preface is the source of this opinion: Hutton found many errors in the last figures. There have been no trigonometrical tables of note published since the invention of logarithms, except those which contain logarithms.

The principal tables of logarithms are the following:— The interest attaching to this species of table makes us dwell a little more on the earlier specimens.

§ 6. 1614. Napier, 'Mirifici Canonis Logarithmorum Descriptio,' Edinburgh. Sines and hyperbolic logarithms of sines and tangents, to every minute and seven decimals.

1616. Reprint of the above, by Edward Wright, to one figure less, with Napier's explanation translated into English, and preface by Briggs, London.

1617. Briggs, 'Logarithmorum Chilias Prima,' London.

1618. Benjamin Ursinus, 'Cursus Mathematicus,' Cologne, contains Napier's Logarithms. His 'Magnus Canon,' Cologne, 1624, contains a recomputation of the Napierian logarithms of sines, to every ten seconds.

1619. John Speidell, 'New Logarithms.' A new arrangement of Napier's, but giving sines, tangents, and secants, with numbers also to 1000. Reprinted in 1627.

1619. Napier, 'Mirifici Logarithmorum Canonis Constructio,' Edinburgh, edited by Napier's son.

1620. Reprint of Napier, both the 'Descriptio' and the 'Constructio,' at Lyons, by Bartholomew Vincent, bookseller.

1620. Gunter, 'Canon of Triangles,' first trigonometrical canon, with Briggs's Logarithms.

1624. Briggs, ''Arithmetica Logarithmica,' London. Logarithms (decimal) to fifteen places, from 0 to 20,000, and from 90,000 to 100,000. After his death, in 1631, a reprint was made by one George Miller; the Latin title and explanatory parts were replaced by English ones; 'Logarithmicall Arithmetike,' &c. We must doubt the reprint of the tables, and think that they were Briggs's own tables, with an English explanation prefixed, in place of the Latin one. Wilson (in his History of Navigation, prefixed to the third edition of Robertson) says that some copies of Vlacq, of 1628, were purchased by our booksellers, and published at London with an English explanation premised, dated 1631. Mr. Babbage (to whose large and rare collection of tables we have been much indebted in this article) has one of these copies; and the English explanation and title is the same as that which was in the same year attached to the asserted reprint of Briggs. We have no doubt that Briggs and Vlacq were served exactly in the same manner.

1624. Kepler, 'Chilias Logarithmorum,' Marpurg. (Napierian.) He also republished Napier's own table in the Rudolphine Tables (1627). Reprinted at Strasbourg in 1700.

1626. Wingate, 'Arithmetique Logarithmique,' Paris (reprinted at Gouda, in 1628, according to Murhard). Wingate was an Englishman who first carried Briggs's logarithms into France. The work was reprinted in England, in the same year. Dodson, Hutton, Ward, &c., say the year of the French publication was 1624, but Lalande and Delambre knew of none previous to 1626, and a copy of the last date which we have examined bears no mark of being a second edition, and refers to nothing as published before, except a tract on the rule of proportion (Gunter's Scale). The logarithms are from Gunter.

1626. John Maire, 'Canon Mesotetologisticus,' &c.. Leyden. Such a work is mentioned by Murhard from Scheibel. It contained sines of minutes, to 7 decimals, in Napierian logarithms; with differences to ten seconds.

(?) 1626. Henrion's Logarithms, Paris. (Dodson, followed by Hutton.) Lalande knew nothing of this work, nor Delambre. Sherwin (Preface) says he examined his table by one of Vlacq's in large octavo, printed at Gouda, in 1626, of which table we find no other mention.

1628. Adrian Vlacq, 'Arithmetica Logarithmica,' Gouda. The whole ten chiliads of numbers, from 0 to 100,000, to ten decimals. Sines, &c. to every minute.

1631. Norwood, 'Trigonometrie.' Logarithms to seven places; numbers to 10,000, sines, &c. to every minute.

1632. Cavalieri, 'Directorium Generale Uranometricum,' Bologna. Eight-figure logarithms, the ten first thousand numbers in columns of twenty: the sines, &c. to various divisions in different parts of the quadrant. It would be very convenient to have a short mode of denoting change of intervals; the following could hardly be misunderstood:—Cavalieri's tables are, 0 (1″) 5′ (5″) 10′ (10″) 20′ (20″) 30′ (30″) 1° 30′ (1′) 45°. The table of logarithmic versed sines is said to be the first given. Cavalieri gave logarithms again in his trigonometry (1643); and in his 'Tabula Trigonometrica,' of which we do not know the date.

1633. Gellibrand, 'Trigonometria Britannica,' Gouda. Briggs's work, which he did not live quite to complete. Sines, tangents, and secants, with logarithms of the two former, all to fifteen places of decimals, except the tangents and secants, which are to eleven. It is to hundredths of degrees, not to minutes.

1633. Vlacq, 'Trigonometrica Artificialis,' Gouda. Logarithms of sines, tangents, and secants, to every ten seconds, and to ten places of decimals. Twenty thousand of Briggs's logarithms of numbers are added.

1633. Nathaniel Roe, 'Tabulæ Logarithmicæ,' London. Seven-figure numbers to 100 thousand, ten-figure sines, &c. to hundredths of degrees. The first table in which attempt at compression was made: the numbers are in columns of fifties, the first figures of the logarithms being at the top.

1634. Herigone, 'Cursus Mathematicus,' vol. iii., Paris, Said to be the first digested course of mathematics; contains logarithms, apparently from Wingate's French of 1626.

1634. Frobenius, 'Clavis Univ. Trigon.' The (by that time) usual Briggs's logarithms to seven places.

1634. Cruger, 'Praxis Trig. Logarith. cum Logar. Tab.,' &c., Amsterdam.

1635. Cruger, 'Doctrina Astronomiæ,' Dantzig. Contains logarithmic tables.

1635. Gellibrand, 'Institution Trigonometricall,' London. Numbers to 10,000 (seven places?); sines, &c. to every minute (seven places). In the same year, at the end of Well's 'Sciographia,' to which Gellibrand wrote a preface, are tables agreeing with the above description, in everything but the logarithms of numbers, which are carried to 10 places. Are these two different tables?

1635. Anonymous, 'Logarithmeticall Table,' London. Attributed to Wingate. Dodson is followed by Hutton in saying that Wingate published an English edition of his French logarithms. But Hutton never saw any prior to this of 1635, and we can find no mention of anything of Wingate's translated from French, except (in an old catalogue which gives no dates) 'The Construction and Use of the Logarithmeticall Tables,' not tables themselves. The logarithms of the table now before us are of six figures, and for the first time units' figures are at the head of the columns, and the tens down the margin. There are tables of 1632, attributed to Wingate.

1654. John Newton, 'Institutio Mathematica,' London, 2 vols., 12mo. Contains tables.

1657. Oughtred's Trigonometry, London, published both in English and Latin in the same year. The logarithms however are from the same type, with the Latin title, in both; they are complete six-figure logarithms: the numbers, which go to 10,000, having seven figures.

1657. John Newton, 'Help to Calculation,' &c. for converting sexagenary tables into decimal by logarithms.

appeared, John Newton, 'Trigonometria Britannica,' London. the old logi... logarithms of sines, &c. are 0 (0°·001) 3° (0°·01) logarithms (for... and Walton), thenals; also sines and logarithms of sines to 14 ments of Navigation logarithms of numbers are thrown into the form which they have ever since preserved in seven-figure tables.

With John Newton we may very well close the account of the early tables of logarithms. From his date we shall give only those which have had great notoriety, or would even now be of use to any one into whose hands they fall.

1681. Jonas Moore, 'New Systeme of the Mathematics,' London. The second volume contains a full table of seven-figure logarithms, with the natural sines, &c., and a table of proportional parts. Also, for the first time in England, a complete minute-table of natural and logarithmic versed sines.

1706. Sherwin, 'Mathematical Tables,' London. The first work, we believe, in which the proportional parts are in the same page with the logarithms; and the common differences in the trigonometrical logarithms made common. Second edition, 1717; third, revised by Gardiner, and the best, 1742; fifth and last, 1771, very erroneous—the most inaccurate table Hutton ever met with.

1717. Abraham Sharp, 'Geometry Improved,' London. A large table of areas of the segments of circles: but it contains logarithms of all numbers to 100, and all primes under 1100, true to sixty decimals. Also an immense mass of results on the regular solids.

1742. Dodson, 'Antilogarithmic Canon,' London. This work is unique of its kind: it contains the number, to eleven figures, corresponding to every logarithm from ·00001 to 1·00000: the author corrected the faults in most copies with his own hand. Harriot began such a table, according to Wallis, and Dr. Pell told Wallis that Warner had finished the table, and that it was in the hands of Dr. Busby, master of Westminster School. It was never published, and is probably lost.

1742. Gardiner, 'Tables of Logarithms,' London. Numbers 1—102100, sines, &c., 0 (1″) 72′ (10″) 45°, all to seven places, with logistic logarithms, &c. Rare, and much esteemed for accuracy: the author corrected the faults with his own hand.

1770. Reprint of Gardiner at Avignon, by Pezenas, Dumas, and Blanchard, with the first four degrees to single seconds, from a manuscript of Mouton. (Lalande.) There was a reprint of some sort at Florence, in 1782.

1772. Gherli's Logarithms, Modena. Very much the same as Hutton's in their contents.

1778. Schulze, 'Sammlung Logarithmischer,' Berlin. This collection is highly spoken of. It contains the last published hyperbolic logarithms of sines and tangents.

1785. Hutton, 'Mathematical Tables,' London. Many editions. A very correct set, with sines, tangents, &c., and versed sines, complete, both natural and logarithmic. For those who want seven places, and can have but one book, there is none better.

1792. Michael Taylor, 'Tables of Logarithms,' London. In the trigonometrical part the sines and tangents are *to every second*. The errata of this work have been published in various Nautical Almanacs.

1783 and 1795 (new tirage, 1821, with many errors corrected). Callet, 'Tables Portatives,' &c., Paris. The first edition was substantially that of Gardiner; the second, *stereotyped* by Firmin Didot, is one of the most correct and convenient, as well as extensive works in existence: many persons prefer it to any other. It contains the usual seven-figure logarithms from 1 to 108000—common and hyperbolic logarithms, each to 20 decimals, up to 1200—logarithms, common and hyperbolic, to 18 decimals, with first, second, and third differences, from 101000 to 101179—numbers to logarithms, common and hyperbolic (to 20 figures), from ·00001 to ·00179, with the same differences, common logarithms to 61 decimals, and hyperbolic to 48, to all numbers from 1 to 1000 and all primes to 1097; the same for numbers from 999980 to 1000021—multiples of 2·30258 . . . and ·43429 . . . to 100 times—arcs to 25 decimals, for both sexagesimal and centesimal division—seven-figure sines, &c. for each minute of the centesimal division—sines (15 decimals) and their logarithms (the remaining places up to 14, the first seven being in the last table)—proportional parts—sexagesimal seven-figure logarithms of sines and tangents 0 (1″) 5° (10″) 45°—logistic logarithms. Those tables are tolerably, but, we believe, not extremely, correct in all parts, except in the latest tirage. They were the first in which the line was broken at the change of the third figure of the logarithm of a number.

1791-1807. Maseres, 'Scriptores Logarithmici,' London. The first volume contains a reprint of Kepler's Logarithms, the sixth and last of Napier's work of 1614, and John Sperdell's logarithms of numbers.

1794. Vega's edition of Vlacq, 'Thesaurus Logarithmorum,' Leipsic, 1794. See Vlacq of 1628 and 1633. A very correct work: a ducat was offered for every error detected.

1797 and 1812. Vega, 'Tabulæ Logarithmico-Trigonometricæ,' Leipsic. The usual logarithms of numbers, sines, &c. 0 (1″) 1° 30′ (10″) 6° 2′ (1′) 45°—divisors and primes already noticed—eight-figure hyperbolic logarithms from 1 to 1000, and for all primes up to 10,000—powers of hyp. log. 10, and their common logarithms (from exponent ·01 to 10·00)—squares and cubes of numbers up to those of 1000, &c.—logistic logarithms, binomial coefficients, and astronomical tables various. There are various smaller editions from Vega, as at Leipsic, 1820 and 1826.

1800 or 1801. (An IX.) Delambre and Borda, 'Tables Trigonométriques Décimales,' Paris. These tables were corrected from the grand *Tables du Cadastre*, still unpublished.* [Prony.] They contain, the common logarithms of numbers, 11-decimal logarithms of numbers from 1 to 1000, and from 100,000 to 102,000; 11-decimal logarithmic sines 0 (10″ centesimal) 100°; 11-figure hyperbolic logarithms from 1 to 1000; 7-decimal logarithms of sines, tangents 0 (1″) 2° (10″) 100° centesimal.

1814. Barlow's Tables, London. Here are found eight-figure hyperbolic logarithms up to that of 10,000, calculated from the primes in Vega. They had been previously printed in Rees' Cyclopædia.

1818. Gruson's Logarithms, Berlin. Contains also squares, cubes, square roots, and cube roots up to 1000.

1827. Babbage, 'Tables of Logarithms,' London. *Stereotyped.* Seven-figure logarithms of numbers only, now exceedingly correct. Printed on various coloured papers: Callet's stereotyped sines were at one time printed on yellow paper in France to accompany them; but the French paper was of so bad a colour, that we believe the experiment was not continued.

1827. Salomon, 'Tables de Logarithmes,' Vienna. A large collection: contains also squares, cubes, square roots, cube roots, up to those of 1000; and divisors up to 102,011.

1827. Hantschl's Tables, Vienna. Ten-figure logarithms of primes up to 15,391; squares, cubes, square and cube roots, up to those of 1200; factors up to 18,277; and others.

1827. G. F. Ursinus, 'Logarithmi,' &c., Copenhagen. A complete six-figure table: rather common in England.

1829. Bagay, 'Nouvelles Tables Astronomiques,' Paris. An imitation of Michael Taylor's, sines and tangents to every second.

1830. Hassler, 'Logarithmic, &c. Tables,' in a pocket form, New York. Seven-figure logarithms throughout: to half-minute intervals through the greater part of the tables of sines, &c. The logarithms of numbers broken as in Callet. We dislike this mode extremely; but many find it convenient.

1831. Lalande, 'Tables de Logarithmes,' Paris. *Stereotyped* in 1805; 1831 is the date of the first *tirage* with all corrections made. Five-figure tables throughout, and no mistake has ever been found in them, though it is said a reward was offered for any detection. There are, we believe, Brussels and other editions which have not the same character. The original work of Lalande, or Lacaille, Lalande, and Marie, had six places; last edition 1804; there was another, bearing the name of Lalande only, stereotyped in 1804. A similar table, with *seven* decimals, has been published for the use of students preparing for the Polytechnic School, and is sometimes furnished for the genuine Lalande: it is useless for ordinary purposes. If the English reprint of the tirage of 1831 (presently noted) be as correct, and no error has yet been found, it is much the better as to type and paper.

1834. Wallace, 'Mathematical Calculator,' Glasgow. Six-figure logarithms, with other tables.

1836. Anonymous (Simpkin, Marshall, and Co.), 'Logarithmic Tables.' A very neat reprint of Hassler without the (to us) objectionable breaking of the lines in the logarithms of numbers.

1839. Anonymous (Taylor and Walton, under Useful Knowledge Society). *Stereotyped.* A reprint of Lalande (*tirage* of 1831) with a few additions, closely compared with other tables. No error was found in Lalande, and none has hitherto been found in this reprint. The old numeral type was first completely restored in this work.

1840. Anonymous (Taylor and Walton), Four-figure logarithms on a card. *Stereotyped.* Reprint of a table originally privately circulated among practical astronomers. (See *Companion to the Almanac* for 1841.)

1842. Sines and tangents to match. Stereotyped.

1840. Farley, 'Six-figure Logarithms,' London. Stereotyped. An excellent table for those who want six figures.

1841. Gregory, Woolhouse, and Hann, 'Tables for Nautical Men.' Contains five-figure logarithms, neatly printed; the only instance we know in which five-figure logarithms have proportional parts.

1841. Riddle, 'Tables,' &c. The six-figure logarithms from Mr. Riddle's well-known work on navigation. *Stereotyped.*

Of the misuse of tables, no instance is more common than that which consists in taking tables of too many places of figures. Four are very often enough, more than five are rarely wanted; but when this happens, tables of seven figures are more conveniently used than those of six, owing to the saving of calculation which is made by the presence of proportional parts. In purely trigonometrical calculations, the advantage of six figures over five sometimes makes itself apparent. It is our own practice, when five figures are suspected to be insufficient, to have recourse to seven at once, which, we are satisfied, is a saving both of time and thought.

§ 7. The next tables which we shall mention are those which are wanted in the higher mathematics.

Extensive tables of *elliptic functions* are in Legendre's 'Traité des Fonctions Elliptiques,' 2 vols. 4to., 1825 and 1826. The *factorial* function, Γx, is tabulated in the same work; and also in the 'Exercices du Calcul Intégral' of the same author, Paris, 1817, in which several other definite integrals are also tabulated. An abridgment of this table (with ready means of restoring it fully) is in the treatise on the Differential Calculus (*Lib. U. K.*), p. 587. Tables of the integer form of Γx, or $1.2.3\ldots(x-1)$, or rather of the logarithms of the values, are given by C. F. Degen, 'Tabularum Enneas,' Copenhagen, 1824, up to $x=1201$, to 18 decimal places: this table is reprinted to six decimal places at the end of the article 'Theory of Probabilities' in the Encyclopædia Metropolitana. Tables of the integral $\int \varepsilon^{-t^2} dt$ were first given by Kramp, with logarithms of the values, in 'Analyse des Refractions Astronomiques,' Strasburg, 1799. This table is reprinted in the Encyc. Metrop., art. 'Theory of Probabilities.' The form in which this integral more usually occurs in the theory of probabilities (with the factor $2:\sqrt{\pi}$) was given (by Professor Encke, we believe) in the Berlin 'Astronomisches Jahrbuch' for 1834, from whence it was copied into the article in the Encyc. Metrop., above noticed; and (with extensions) into the 'Essay on Probabilities and Life Contingencies' in the Cabinet Cyclopædia, and into the article on Probability in the new edition of the Encyclopædia Britannica. A few other definite integrals have been tabulated: one very useful one, $\int dx : \log x$, by Soldner, 'Nouvelle Fonction Transcendente,' Münich, 1809, copied into the 'Differential Calculus' (*Lib. U. K.*), p. 662. The integrals known by the name of Spence's *Logarithmic Transcendants* are in the work with that title (Edinburgh, 1809; Sir J. Herschel's edition, London, 1820). There are a few of the integrals necessary in optics scattered through the Memoirs of the Institute and of the Cambridge Philosophical Society (in memoirs by Fresnel and Mr. Airy). Perhaps we should also mention the tables for the solution of indeterminate equations of the second degree. Of these there is one in Legendre's 'Théorie des Nombres'; another has been given by Jacobi; and a third, by Degen, called 'Canon Pellianus.'

As to astronomical tables, it would be impossible to give any account of the enormous mass which exists or has existed: nor would such an account be of any use,

* There was once a commencement of the printing made, and we have seen some of the proof sheets.

for astronomical history. They may be divided into two classes: first, the tables of observations published by public or private observatories; secondly, the fundamental tables deduced from observations, to aid in the deduction of future predictions. As to the former, every well-conducted observatory in full work publishes periodically (at intervals of one or two years) its volume of observations, latterly with their reductions. As to the second class, they are not the daily materials of the astronomer, but of the computer of his ephemeris, who supplies the necessary predictions for the current year. In England the Nautical Almanac gives in the preface full references to the tables employed in predicting places, whether of sun, moon, planets, or stars. For general purposes connected with the elements of the solar system, see Baily, 'Astronomical Tables and Formulæ,' London, 1827.

The tables in the other physical sciences are mostly collections of facts, and, we believe, generally speaking, by no means so complete as they might be. The value of tabular information seems to be not sufficiently felt. A large portion of every book of chemistry, for instance, is a detailed statement in words at length of facts which might with great advantage be made the components of a table.

§ 8. It remains to speak of commercial tables, a subject of great interest in this country, which has produced a great many. The mathematical tables connected with this subject may be divided into those intended to facilitate calculations of money with regard to other countries, and with regard to transactions in this country; to which we must add, as distinct heads, tables of annuities and other life contingencies, and metrological tables, or tables of weights and measures. Of all these we shall only mention a very few.

The most complete work on foreign exchanges, and on the weights and measures of England as compared with those of other countries, is 'The Universal Cambist,' &c., London, 1821 (2nd edition), 2 vols. 4to. (with supplements), by the late Dr. Patrick Kelly. We may also mention Tinks's Arbitration of Exchanges, London, 1817.

Tables of interest began to be published at the beginning of the seventeenth century. The earliest we have met with is Richard Witt, 'Arithmeticall Questions,' London, 1613, which, before the introduction of the notation of decimal fractions, gives tables or *breviats* containing the significant figures, with rules equivalent to the management of the decimal point; and Clay's 'Briefe, &c. Tables,' London, 1624. In the first half of that century we find in catalogues the works of Fisher, Butler, Webster, and others, with anonymous writers, all containing tables of interest, annuities, or leases. For the tables known by the name of Æcroid, see MORTALITY. The tables of leases, Cambridge, 1686, had the approbation of Newton, as Lucasian professor, and have since been often reprinted, and styled Newton's. Under this impression they still are sold, as there are persons who believe they were constructed by Newton. In 1726 the first really extensive tables of interest were published by John Smart. The results are interpolated for half years, which give the tables the appearance of being calculated for interest payable half-yearly; but the fact is that yearly payments are supposed. A second edition of this work, enlarged, by C. Brand, London, 1780, has the reputation of containing many errors. Mr. Baily's 'Doctrine of Interest and Annuities,' London, 1808, is as extensive as Smart's for whole years, and as correct; and the Tables of Leases, London, 1807, by the same author, contain the simple cases which the name implies, tabulated by themselves. The 'Doctrine of Interest,' by Francis Corbaux, London, 1825, contains the real distinction of yearly, half-yearly, and quarterly interest: these tables are repeated in the same author's work on Population, London, 1833. Mr. Hardy's 'Doctrine of Simple and Compound Interest,' London, 1839, contains rates of interest increasing by ¼ per cent. from ¼ up to 5 per cent., with succeeding integer rates. All the standard works on life annuities contain tables of compound interest.

1. There seems to have been a tendency at the beginning the last century to publish commercial tables in copper-[illegible]te, probably with a view to secure the advantage which type has since secured in a better form. Thus we 'arithmeticall tables' of C. Bardon (Roy. Soc. without date; Lostau's 'Manual Mercantile,' second book (first never published), London, 1733; Rev. G. Brown's Arithmetica Infinita, London, 1717; the two last being multiplication tables with multiples of numbers and fractions useful in money transactions, arranged under heads. The following may be mentioned as containing hints which might even now be useful: Benjamin Webb, 'Tables for Buying and Selling Stocks,' London, 1759; also 'The Complete Annuitant, or Tables of Interest,' London, 1762; Hayes's 'Moneyed Man's Guide,' a table for Computing Dividends, London, 1726. The French have a large number of tables answering to our ready reckoners, under the names of Barême (a word of the same use with them as Cocker with us) compt-faits, &c. We have seen one of them of the decimal character, in which a metal plate with rectangles pierced in it serves, on one rectangle being placed over the integers of the number given, to make another separate those of the number to be found.

On the standard tables of life contingencies we refer to MORTALITY, adding that since the publication of that article, the Amicable Society has published tables of its experience by distributing them in print among their proprietors. The work of Mr. Jones on *Life Annuities*, in the 'Library of Useful Knowledge,' which is now brought nearly to a close, contains more tables than the old standard works all put together, and is the first in which extensive tables for what is called *Barrett's Method* are furnished, both for one and two lives.

The practice of stereotyping tables is one which should be strongly enforced, if it were not that publishers seem now to be aware of its importance. A second edition derives no authority from the goodness of the first, because the printer, who is, as already observed, as important a person as the author in the matter of tables, has again stepped between the latter and the public. In reading the proofs of important tables, it is desirable that three persons should be employed, one to read from the manuscript, the others to watch two separate proofs, without communication with each other, as done in the Nautical Almanac Office. The strictest investigation should take place in the proof which is taken from the stereotype, ordinary pains being taken with the previous proofs. Persons who have to correct the proofs of tables alone should bring the manuscript as near as possible to the proof by folding it conveniently: even if the folds were altered after every two or three lines, so as always to have both manuscript and proof under the eye in one position, it would not give more trouble than would be well repaid. Double figures should be particularly attended to; no mistake is so likely to be made, either by the compositor or the reader, as 744 for 774, and the like. This, and misplacing the order of the figures, as 012 for 102, are the things which it is most difficult to avoid. Again, of the two things under examination, manuscript and proof, the more difficult one should be looked at first, for the mind is apt to allow knowledge derived from the more easy to give help in interpreting the more difficult. Thus if the type be harder to read than the manuscript (a very common thing with our thick even-sized numerals), make out the proof first, and then look at the manuscript; and *vice versâ*. If two readings be given, vary the mode; the following may for instance be the plan adopted: if the manuscript column contain *a*, *b*, *c*, &c., and the printed column A, B, C, &c., look at *a*, compare it with A, then at B, compare it with *b*, then at *c*, compare it with C, and so on; the order of inspection being *a*A, B*b*, *c*C, D*d*, &c. Some persons examine best by the eye alone, others by the ear also, repeating aloud. Each one must ascertain for himself which practice is best for him; but whatever it may be, it should be varied. Alteration of position, motion of the hand or foot occasionally to mark the transitions, change of the tone of repeating, &c., are useful: it is hardly credible, to those who have not tried, how much the perceptions are dulled by the monotonous comparison of one column of figures with another, or how many and how gross errors both eye and ear, when tired, will suffer to pass. Persons who are not much used to this labour might very well proceed as follows. Let them request the printer to make, at his own discretion, a certain number, say three, of mistakes (author-traps) in every page, carefully registering them, but not on the manuscript. The author may then be certain that he ought to detect three mistakes in every page, and will know that he has been careless if he have

not that number at least. But at the same time, an author who has not reason for confidence in himself, may very safely leave good manuscript tables entirely to the printer, if he make the latter understand that he does not intend to correct till all is printed off, and will require every page containing an error to be cancelled. No good printer would now refuse to engage to furnish a fac-simile of a manuscript, on the simple condition of being allowed to refer to the author for decision as to any doubtful word or figure in the writing; and the accuracy with which the first-rate London printers turn out their proofs is surprising. We have frequently looked at page after page of table-matter more times than we should otherwise have thought necessary, merely because the total absence of detected error left it an unsettled point whether it was the excellence of the proof, or a temporary suspension of our own quickness of perception, which caused the absence in question.

Catalogues of tables (separate) may be seen in the catalogue of the Royal Society's Library; in Murhard's *Bibl. Math.*; in Lalande's *Bibl. Astron.* (in virtue of the index); but there is nothing approaching to even a moderately perfect catalogue.

TABLE, ROUND. The most famous Round Table is that of King Arthur, which is said in the old romances to have been constructed by the wizard Merlin for Uther Pendragon, Arthur's father, from whom it passed into the possession of Leodigan, or Leodegrance, king of Camelard, or Carmalide, whose capital was Carshaise, and then came to Arthur as the portion of his wife Guenevre, daughter of that monarch. The romance of the 'Mort d'Arthur' says that Merlin made it 'in token of the roundness of the world;' according to the metrical romance of Merlin, it was made in imitation of one which had been set up by Joseph of Arimathea in commemoration of that at which the twelve apostles ate the last supper with their divine Master. The Round Table is not mentioned at all by Geoffrey of Monmouth, either in his 'Chronicle,' or in his 'Life of Merlin' in Latin verse; but it is noticed by his contemporary Wace of Jersey, in his metrical 'Roman de Rois d'Angleterre.' The Round Table was 'intended,' to quote the analysis of the romance of Merlin given by Ellis (*Specimens of Early English Romances*, i., 249), 'to assemble the best knights in the world. High birth, great strength, activity and skill, fearless valour, and firm fidelity to their suzerain were indispensably requisite for an admission into this order. They were bound by oath to assist each other at the hazard of their own lives; to attempt singly the most perilous adventures; to lead, when necessary, a life of monastic solitude; to fly to arms at the first summons; and never to retire from battle till they had defeated the enemy, unless when night intervened and separated the combatants.' There are different accounts of the number of the Knights of the Round Table, which indeed appears not to have been always the same. The romance of Merlin, which states that Uther had no power to fill all the seats, makes that king nevertheless to have nominated 250 knights, and these are also spoken of as forming the number of the order under Leodegrance. The 'Mort d'Arthur' makes Leodegrance say, in surrendering it to Arthur, 'I shall give him the Table Round, the which Uter Pendragon gave me, and when it is full complete, there is an hundred knights and fifty; and, as for an hundred good knights, I have myself, but I lack fifty, for so many have been slain in my days.' Of the fifty knights that were wanted, Merlin was at the moment only able to find twenty-eight for Arthur; but some were added afterwards. Other accounts again make the complete number under Arthur to have been only a hundred. It is asserted by some of the chroniclers that some time before Edward III. instituted the order of the Garter, he established in the castle of Windsor a fraternity of twenty-four knights, and erected for them a round table, in imitation of that of Arthur, with a chamber in which it was placed, still known by the name of the Round Tower; and though this story is rejected by Antis, in his 'History of the Order of the Garter,' Warton (*Hist. of Eng. Poet.*, ii., 87) gives some reasons for thinking it probable enough. Bishop Percy, in his 'Reliques of Antient English Poetry' (i., 41, 42), remarks 'that the round table was not peculiar to the reign of King Arthur, but was common in all the ages of chivalry. The proclaiming a great tournament (probably with some peculiar solemnities) was called holding a Round Table.' And he quotes a passage from Dugdale, in which that learned antiquary, describing a tournament held at Kenilworth by Roger de Mortimer, in the reign of Edward I., says, 'Then began the Round Table, so called by reason that the place wherein they practised those feats was environed with a strong wall made in a round form.' Percy adds that Matthew Paris frequently calls jousts and tournaments *Hastiludia Mensæ Rotundæ*. These round tables were probably a contrivance on the principle of the modern Round Robin, to prevent any dispute about precedency. There are several circular elevations in different parts of England which are still called Arthur's Round Tables.

TABLES, TWELVE. [Twelve Tables.]

TABOR, MOUNT (תָּבוֹר; LXX., and Josephus, Ἰταβύριον), now called Jebel-et-Tûr, is an insulated eminence, about 1000 feet high (according to the most probable out of several different calculations), on the eastern side of the great plain of Esdraelon in Palestine. It lies about two leagues south-east of Nazareth. It stands out alone from the high ground which surrounds Nazareth, and on the north it has at its foot an arm of the great plain of Esdraelon, which sweeps away north-east to the lake of Tiberias. The mountain consists of limestone. Its form, as seen from the south-west, is a segment of a sphere; from the west-north-west it presents the appearance of a truncated cone. The ascent is long and winding, occupying generally about an hour; the path is of antient construction; in some places steps are cut in the rock. The sides have a good soil, and are covered with clumps of oak-trees. 'The proper summit,' says Dr. Robinson, 'consists of a beautiful little oblong plain or basin, twelve or fifteen minutes in length from north-west to south-east by six or eight in breadth. This is skirted on the south-west by a ledge of rocks of some altitude, covered with foundations and ruins, and on the north-east by lower rocks; and this higher ground on both sides is thickly overgrown with bushes and small trees, while the basin itself lies in grass without trees or ruins.'

There are considerable ruins on the summit of the mountain. There are traces of a thick wall all round the top, the masonry of which seems not later than the time of the Romans. This is very likely to be the wall built round the mountain by Josephus, in the Jewish war. (*Vit.*, § 37; *Bell. Jud.*, ii., c. 20, § 6.) On the ledge of rocks at the southern side of the summit, particularly at its eastern end, there are large ruins of fortifications, and apparently of dwelling-houses. There is a gateway, of Saracenic architecture, called 'the Gate of the Wind.' It is known that churches and monasteries stood here both before and during the Crusades. There is a small vault on the south-east, where the Latin monks from Nazareth celebrate an annual mass in memory of the Transfiguration, and on the north side the Greeks observe the same festival among the ruins of a church. The festival of the Virgin is also celebrated here by the Greek priests from Nazareth, and a multitude of pilgrims. There are many cisterns on the summit; most of them are dry, but in one Dr. Robinson found good water.

All travellers describe the view from Mount Tabor as very beautiful, but they differ about its extent. Dr. Robinson, who spent a whole night on the mountain, and saw the view both in the evening and in the morning, states that on the west it embraced the western part of the plain of Esdraelon, but the ridge of Carmel almost entirely intercepted the sea view. On the north and north-east appeared Safed and its mountains, overtopped by the snowy summits of Jebel Es-Sheikh (Mount Hermon): between the mountains of Safed and the foot of Tabor lay the north-east branch of the plain of Esdraelon. Though only a spot of the water of the lake Tiberias could be seen, the whole outline of its basin was clearly visible; and beyond this the table-lands of Jaulân and Haurân, and to the south of them the mountains of Bashan and Gilead. On the south the view is almost immediately bounded by the mountains of Duhy (Little Hermon) and Gilboa, the latter appearing over the summits of the former. On the south-east the view extends far down the valley of the Jordan. Dr. Robinson adds that a line drawn from Tabor to the summit of Little Hermon marks the division between the waters which run eastward into

the Jordan and those which flow westward through the plain of Esdraelon into the Mediterranean.

The name of Tabor occurs several times in the Old Testament (*Josh.*, xix. 12, 22; *Judges*, iv. 6, 12, 14; *Psalms*, lxxxix. 12; *Jerem.*, xlvi. 18; *Hosea*, v. 1.) There was upon it one of the cities of the Levites, belonging to the tribe of Zebulon. (1 *Chron.*, vi. 77.) The description given by Polybius (v. 70, § 6) of the city of Atabyrium (Ἀταβύριον), as well as the name itself, proves it to have been Tabor.

This city was taken by stratagem and fortified by Antiochus the Great, B.C. 218 (Polyb., *l. c.*). In the Jewish war a battle was fought at the mountain between the Romans under Gabinius, and the Jews under Alexander, the son of Aristobulus, about B.C. 53 (Joseph., *Antiq.*, xvi., c. 6, § 3; *Bell. Jud.*, i., c. 8, § 7); and the summit, as above mentioned, was afterwards fortified by Josephus. At a later period of the war a great multitude of the Jews, who had taken refuge here, were compelled to surrender to Placidus. (Joseph., *Bell. Jud.*, iv. 1, 8.)

Tabor is not mentioned in the New Testament; but in the fourth century after Christ the opinion seems to have sprung up, which has since been generally held, that it was the scene of our Saviour's Transfiguration. (*Matt.*, xvii.; *Mark*, ix.; *Luke*, ix. 28; 2 *Pet.*, i. 18.) It has been long since observed by Lightfoot and Reland, that the Gospel narratives rather point to some place on the north of the lake of Tiberias; but Dr. Robinson has set the question at rest by an observation so simple that it is marvellous how it escaped the notice of former writers, namely, that at the very time referred to, the summit of Tabor was occupied by a fortified city.

(Dr. Robinson's *Biblical Researches in Palestine*, vol. iii., pp. 209-225; Winer's *Biblisches Realwörterbuch*, art. 'Thabor.')

TABOR, a circle in the south-east part of the kingdom of Bohemia, is bounded on the north by the circle of Czaslau, on the east by Moravia, and on the south and west by the circle of Budweis. The area is 1170 square miles, and the population 200,000 inhabitants. The country is an undulating plain, with a few hills and mountains. The most considerable river is the Luschnitz, and there are many small lakes or meres. The soil is fertile, and produces corn, flax, and culinary vegetables. Oxen and sheep are very numerous; and the mountains are rich in silver and other minerals, and in precious stones. The chief manufactures are of woollen, cotton, and linen.

TABOR, the capital of the circle of Tabor, is situated in 49° 24′ N. lat. and 14° 30′ E. long. It stands on an eminence called Mount Tabor, on the river Luschnitz, in a romantic country. It is said that the castle of Tabor was built in the year 774, by a nobleman named Koten, round which the town gradually arose, but it was totally destroyed in 1268. In 1420 it was rebuilt, and strongly fortified, by Zisca, leader of the Hussites, part of whom were called, after the town, Taborites. The principal buildings are the cathedral, which is worth seeing, and an Augustine monastery. The town has 4500 inhabitants, among whom there are many Jews. Their chief occupation is weaving linen and woollens, and they have some trade in corn. (Blumenbach, *Die Oesterreichische Monarchie*; R. E. v. Jenny, *Handbuch für Reisende im Oesterreichischen Kaiserstaate*.)

TABRIZ, the capital of Azerbijan, a province of Persia, is situated, according to Monteith, in 38° 4′ N. lat. and 46° 8′ 30″ E. long. The town is said to have been founded by the wife of the famous Caliph Harun al Rashid, in 791. It was repeatedly destroyed by earthquakes, and in 1635 by Murad IV., the Turkish emperor, but it was always restored. In Chardin's time (1673) it was a very large town, equal in size to Ispahan, and containing 500,000 inhabitants; but this statement was made by Chardin on the information collected from the natives, and is apparently a great exaggeration; even now the natives give to the town a population of 250,000 individuals, though, according to the estimate of travellers, it hardly exceeds 50,000. During the last century Tabriz was more than once taken by the Turks, damaged by earthquakes, and reduced to a very low state; but at the beginning of the present century, Abbas Mirza, the son of the shah of Persia, was made governor of Azerbijan, and organized the military force at Tabriz, which he intended to oppose to the progress of the arms of Russia. Since that time the town has greatly improved, though the larger part of the area enclosed by the antient walls is still covered with ruins and gardens.

Tabriz is built on the elevated table-land which extends from the south-western shores of the Caspian Sea, in a west-north-west direction to the eastern recess of the Black Sea, and whose centre is occupied by Mount Ararat. It lies towards the south-eastern termination of this table-land, and is about 4800 feet above the sea-level. It is therefore nearly 3000 feet higher than Madrid, and this is the principal reason of the great severity of the climate. Some travellers compare the winters of Tabriz with a moderate winter of St. Petersburg, and others with that of New Brunswick, or of the central states of the North American Confederation. In this season eastern and north-eastern winds are prevalent, and the frost is continual. The thermometer sometimes sinks to zero of Fahrenheit. Monteith states that the mean temperature of the month of February was only 8·2°. Falls of snow are frequent and heavy, and the snow sometimes covers the ground for six months, which was the case in 1821. In these hard winters many travellers lose their lives, and whole caravans are frequently exposed to imminent danger. The easterly winds blow through the narrow valleys of the table-land with a violence of which the inhabitants of Europe can hardly conceive an idea. To the great quantity of snow in winter the fertility of the country is owing; for there are not more than two or three showers between March and December. The air during this time is so extremely dry, that steel, which is continually exposed to it, never shows the least rust, and dew is a thing entirely unknown. The heat of the summer is very moderate. Between the 19th of June and the 1st of July the thermometer only once rose to 75°. Sometimes indeed hot winds blow from the south-west, and raise the temperature of the air considerably, but they are rare, and do not continue for a long time. At other times the air is always pure, dry, and bracing.

Tabriz is built on a plain of moderate extent, surrounded on the north and south by ranges of high hills, which rise into pointed peaks, and present a rugged outline. They are without trees, and barren. The plain is open towards the west, and in that direction it widens gradually as it approaches the banks of the lake of Urmiyeh, to which it extends. The plain is very fertile, and produces abundant crops of grain where it can be irrigated: it also contains extensive plantations of fruit-trees, and is in general the best cultivated and most populous tract in Persia, with the exception of the low countries of Ghilan and Mazanderan.

The town is surrounded by a wall of sun-burnt bricks, which has a circuit of about three miles and a half, and in which are seven gates. The streets are tolerably straight, but not paved. The houses are made low, on account of the earthquakes, and mostly built of sun-burnt bricks. They have no windows towards the streets, but are convenient in the interior. The suburbs are extensive, and the orchards, which cover large spaces, are kept in good order, and watered by numerous keresis (subterranean canals). Grapes, melons, apricots, quinces, pears, and apples are of superior quality. In many of the gardens there are the ruins of magnificent old buildings. There are no buildings distinguished by architectural beauty, not even the mosques. The most remarkable is the old castle, which was built by Ali Shah.

The manufactures of Tabriz are not extensive, with the exception of those of cotton cloth, which only produce coarse goods for the consumption of the lower classes. There are a few silk-weavers, who receive the material from Mazanderan, but the produce of their industry is indifferent. Tabriz is one of the most commercial towns of Persia. Its principal commerce is with Tiflis in Russia, with Trebizond, and with Constantinople. It sends to Tiflis, by the way of Erivan, silk, cotton, rice, galls, and dried fruits, and receives from Russia, iron, copper, caviar, cloth, Russian leather and other kinds of leather, cochineal, and several manufactured goods, especially iron. It is stated that the annual value of the goods imported from Russia in this way exceeds 300,000*l*. The English manufactures, which were formerly brought to Persia by the port of Abushir on the Gulf of Persia, now reach it by a shorter way, being unshipped at Trebizond on the Black Sea, and carried overland through Erzerum, Bayazid, and

Khoi. Their value is at least equal to that of the goods brought from Russia. Many English goods reach Tabriz by the caravans, which are continually going between that town and Constantinople, and pass through Erzerum, Tokat, and Angora. The export by this road consists chiefly of rice, wool, hides, sheep and goat skins, furs, carpets, shawls, and some minor articles. It is stated that the foreign commerce of Tabriz annually introduces into Persia goods to the value of a million of pounds sterling. The merchants of Tabriz are at present not immediately connected with India and Bokhara, but receive the goods of these countries by the way of Herat and Teheran.

(Eli Smith and Dwight's *Missionary Researches in Armenia*; Kinneir's *Political and Geographical Memoir of the Persian Empire*; Fraser's *Travels in Koordistan, &c.*; Ker Porter's *Travels in Georgia, Persia, Armenia, &c.*; Wilbraham's *Travels in the Trans-Caucasian Provinces, &c.*)

TABULAR SPAR. [WOLLASTONITE.]

TACAZZE, River. [ABYSSINIA; NILE.]

TACCA, a genus of plants of the natural family of Taccaceæ, placed near *Aroideæ* and *Aristolochiæ*, and resembling Dioscoreæ, in having radical tubers which abound in fæcula. The genus is named from the Malay name of one of the species, which are found in the hotter parts of India and in the South Sea Islands. The genus is characterized by having a six-partite calyx, with a six-partite corol, and six stamens which are inserted in the calyx. Styles 3. Stigmas stellate. Berry dry, hexangular, many-seeded. The plants have perennial tubers, with a short compressed rhizoma, from which proceed the stalked and the so-called radical leaves and herbaceous scapes. The plants of this family are possessed of some acridity both in their tubers and in their herbaceous parts, but the roots lose some of this quality by culture, at the same time that they become larger. Those of *T. pinnatifida*, the best-known species, and a native of the Malayan Peninsula, the Moluccas, Madagascar, and New Holland, are roundish, red, the size of a man's fist, extremely bitter, and acrid. The tubers of this plant, and also those of *T. dubia* and of *T. montana*, are rasped and macerated for 4 or 5 days in water: a white highly nutritious fæcula, like arrow-root, is then separated, and, like sago, is employed as an article of diet by the inhabitants of the Malayan Peninsula and the Moluccas. In Otaheite and some of the Society Islands they make cakes of the tubers of *T. pinnatifida*, which are the *Tacca youy* of some navigators. They form an article of diet in China and Cochin China, and also in Travancore, in India, where, according to Dr. Ainslie, they attain a large size, and the natives eat them with some acid to subdue their acrimony. (Royle's *Illustr.*, p. 378.) The petioles and stalks boiled for some time are also used as articles of diet in China and Cochin-China. In Otaheite the plant is called *tya*: its fæcula is largely prepared and is sometimes preferred to that of arrow-root by the English, to whom it is sold under that name by the native converts at the missionary station and exported to London. It is also sometimes called Otaheite salep. This plant must not be confounded with the *Arum macrorhizum*, the tuberous root-stalk of which is also edible, and when prepared is called *taka*, which similarity in name and in uses has frequently caused confusion, and the mistaking of one plant for the other. In Singapore, *Tacca cristata* is called 'Water-Lily.'

TACCA'CEÆ, a small natural order of Endogens belonging to the epigynose group. There are but two genera belonging to this order, Tacca and Ataccia. The species are large perennial herbaceous plants, with a tuberose root, a short stem bearing scapes, and having exstipulate, radical, pedatifid, pinnatifid, rarely entire leaves, with curved parallel veins. The flowers, which are placed on the top of a single scape, are in umbels, and are united; the tube of the perianth is superior, and united to the germen; limb petaloid, equal or unequal, persistent; stamens six; filaments dilated; ovary composed of three connected carpels, with five parietal polyspermous placenta; styles three, connate; the fruit baccate, with seeds lunate, striated, and the embryo situated on the outside of fleshy albumen.

Some difference has arisen amongst botanists as to the position of this order in a natural system. Bartling refers them to Exogens, but almost all other botanists have referred them to Endogens. Blume considers the order as one standing between Araceæ and Aristolochiaceæ, agreeing with the former in habit and the latter in its superior perianth. On account of its inferior fruit and the absence of a spadix, it is placed by Lindley in his epigynous group.

The species are found in the hotter parts of India, in the South Sea Islands, also in tropical Africa. The tuberous roots, as well as the enlarged petioles of many of the species after they have been cooked, are frequently used as food. [TACCA.]

TACHY'DROMUS, Illiger's generic name for the *Courier Birds*, *Cursorius* of Lacépède, *Coure-vite* of the French. [CURSORIUS.]

Mr. Vigors places this form among the *Charadriadæ* [PLOVERS], and Mr. Swainson arranges it in the same family, giving it a position between *Œdicnemus* and *Glareola* [PATRINCOLE], and it stands between the same genera and in the same family in the *Birds of Europe and North America* of the Prince of Canino.

Mr. G. R. Gray makes the *Cursoriinæ* the second subfamily of the same family. The *Cursoriinæ* are placed by him between the *Œdicneminæ* and the *Charadrianæ*, and comprise the following genera:

Cursorius, Lath. (*Charadrius*, Gm.; *Tachydromus*, Ill.); *Oreophilus*, Gould; *Ortygodes*, Vieill. (*Hemipodius*, Sw.; *Ortygis*, Steph.); *Pluvianus*, Vieill. (*Charadrius*, Gm.; *Cursor*, Wagl.; *Hyas*, Gloger.; *Ammoptila*, Sw.; *Cheilodromus*, Rüpp.).

N.B. *Tachydromus* is also used by Daudin to designate a genus of lizards.

This saurian is placed by MM. Duméril and Bibron at the head of their first group of *Autosaures Cœlodontes*, viz. the *Cœlodonts* with smooth toes, or *Leiodactyls*.

Generic Character.—Tongue with a base not sheathing, moderately extensile, divided at its extremity into two small flattened filaments, with a surface offering papillose folds in chevrons. Palate toothed or not toothed. Intermaxillary teeth conical, simple. Maxillary teeth compressed, the first simple, the succeeding ones tricuspidate. Nostrils open at the summit of the rostral canthus, each in a single plate (the naso-rostral). Eyelids. Tympanic membrane extended within the auricular border. A scaly, dentilated, and but little marked collar. Belly furnished with imbricated scales, which are smooth or carinated. Some inguinal pores. Feet each with five toes slightly compressed. Tail very long and cyclotetragonal.

MM. Duméril and Bibron, whose description this is, remark that the *Tachydromi* are distinguished from all other Cœlodont Lacertians by the peculiar form of the papillæ of their tongue, which resemble folds having the figure of chevrons enclosed one within the other, the summit of which is directed forwards.

The same authors add that these Lacertians have a pyramido-quadrangular head, the body a little higher than it is wide, the back slightly convex, the belly flat, and the sides slightly arched outwards. The proportions of their limbs are entirely in unison with the size of the trunk; but the tail is excessively long, longer indeed than in any other autosaur, forming sometimes three-fourths of the total length of the animal. The four first toes of the anterior and posterior feet are regularly graduated (étagés); the fifth has nearly the same length as the second.

The tongue (which is rather wide backwards, where it presents a sort of V-shaped notch, between the branches of which the glottis is situated) narrows as it advances towards its free extremity, which is a point divided into two flattened filaments, on which are no papillose folds similar to those which the greater part of the surface of this organ presents.

In general, the palate is armed with very small teeth; at least MM. Duméril and Bibron have felt some with the aid of the point of an iron instrument in the greater portion of the individuals observed by them. There are about twenty small, conical, simple intermaxillary teeth curved slightly inwards; twenty-six upper maxillaries on each side, and thirty below on each side. The first of these upper and lower maxillaries are simple and conic, whilst all the others are flattened laterally, tricuspidate at their summit, and very close set against each other.

The external nostrils are two circular orifices, rather large, which open at the summit of the frenal region in the rostro-nasal plate.

The upper eyelid is shorter than the lower, the slit is perfectly longitudinal. The ear, or rather its aperture, is

somewhat large and nearly circular; the tympanic membrane is extended within its circumference.

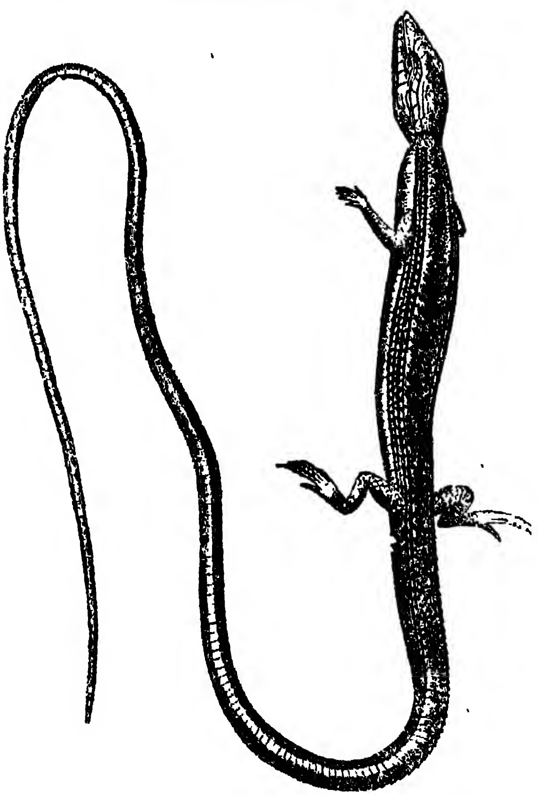
The surface of the head is entirely covered with plates, absolutely as in the Lizards properly so called. There are a rostral plate, two naso-rostrals, an inter-nasal, two fronto-parietals, a small inter-parietal and an occipital equally small. The palpebral or supra-ocular regions, which are bony, have three plates of different sizes. On the frenal region there exists a small naso-frenal plate and two large post-naso frenals. One of the upper labials, that which is situated below the eye, occupies not only a very large longitudinal space, but ascends to the orbital border.

The under part of the neck presents a scaly serrated collar, but in general it is but little apparent. Scales, and not plates, protect the temples.

The scaly covering of the upper part of the neck, of the back, and of the tail, is composed of great carinated, angular pieces, more or less imbricated, and rather distinctly disposed in transversal rows, especially the caudal ones, which are, consequently, verticillated.

The sides, on the contrary, present only very small scales, having a granular aspect. The lower regions of the neck, the breast, and the belly are protected by rhomboidal imbricated scales, which are smooth or carinated, but always disposed in longitudinal series. There are lozenge-shaped imbricated scales on the arms and the front of the hind feet; the under part of the anterior limbs and the posterior surface of the thighs are furnished with granules. The pre-anal region is covered in great part by a single plate surrounded with small scales. The base of the tail presents no kind of spines nor spurs: but there exists in each groin one or two tubular crypts.

Only two species are at present known: *Tachydromus sexlineatus* and *Tachydromus Japonicus*.



Tachydromus sexlineatus.

The first of these is olive above, and on each side of the back, from the angle of the occiput to the lateral part of the base of the tail, is a beautiful white stripe between two black lines; certain parts of the sides of the neck and sides, those which are furnished with granules, are sprinkled with pretty small black spots with a white eye. The other regions of the lateral parts of the neck and the trunk are of a bluish tint with golden reflections. Between the nostril and the eye a black line; two others of the same colour, separated by a white stripe, extend longitudinally on the temple. The lower part of the head, of the neck, of the breast, and of the belly, are very pure nacreous white. The tail sometimes is simply olive; sometimes, on the contrary, it presents a brilliant copper, or even golden colour. Length about a foot, of which the tail measures about three-fourths.

Locality.—China, Cochin China, and Java. (D. and B.)

TACHYGLOSSUS, Illiger's name for the ECHIDNA.

TACHYLITE, a mineral which resembles obsidian, and has also been supposed to be similar to isopyre. It occurs in plates and massive. No cleavage. Fracture small conchoidal. Hardness 6·5. Translucent, opaque. Lustre vitreous, vitreo-resinous. Colour brownish and greenish-black. It is found in small masses at Säsabühl, near Göttingen, in basalt and wacke. It does not appear to have been analysed.

TACHYPETES, Vieillot's name for the *Frigate Bird*. [PELECANIDÆ, vol. xvii., p. 386.]

TACHYPHO'NUS. [FRINGILLIDÆ, vol. x., p. 483; TANAGERS.]

TA'CITUS, CAIUS CORNE'LIUS, was probably born in the reign of Nero, but neither the place of his birth nor the exact date is known, nor is anything known of his parentage. There is no reason for supposing that he belonged to the illustrious patrician gens of the Cornelii, nor any evidence of his having been born at Interamna, as it is sometimes stated. The few facts of his life are chiefly collected from his own works, and from the letters of his friend the younger Pliny. Tacitus was about the same age as Pliny, but the elder of the two. Pliny was born about A.D. 61 [PLINY THE YOUNGER], in the reign of Nero, which commenced A.D. 54.

A passage of the elder Pliny (*Hist. Nat.*, vii., 16) speaks of a son of Cornelius Tacitus, the procurator of the emperor in Belgic Gaul. Lipsius concludes that this Cornelius Tacitus was the historian; but as Pliny died in A.D. 79, it seems hardly probable that the passage can apply to him. It has been conjectured that the procurator was the father of the historian. Tacitus states that he owed his first promotion to Vespasian, and that he was indebted for other favours to his successors Titus and Domitian (*Hist.*, i. 1). In the year A.D. 77, C. Julius Agricola, then consul, betrothed to him his daughter; and the marriage took place after the consulship of Agricola. Tacitus does not state what places he filled under Vespasian and Titus, but in the reign of Domitian he informs us that he assisted as one of the Quindecemviri at the celebration of the Ludi Seculares, which event took place in the fourteenth consulship of Domitian (A.D. 88). At that time he was also praetor (*Ann.*, xi. 11).

He was not at Rome when his father-in-law Agricola died there (A.D. 93), in the reign of Domitian; but it is too much to affirm, as some have done, that he was an exile during the time of Domitian. It has already been shown that he was at Rome in the year A.D. 88. A passage in his Life of Agricola (c. 45) rather leads to the inference that he was at Rome during many of the atrocities which Domitian perpetrated after the death of Agricola, though he had been absent from Rome for four years prior to Agricola's death. On the death of T. Verginius Rufus, in the reign of Nerva (A.D. 97), he was appointed Consul Suffectus, and Pliny enumerates it as the crowning event to the good fortune of Verginius that his panegyric was pronounced by the consul Cornelius Tacitus, the most eloquent of speakers.

Tacitus is recorded by his friend Pliny as one of the most eloquent orators of his age. He had already attained some distinction as an advocate when Pliny was commencing his career. In the reign of Nerva, Pliny and Tacitus were appointed by the senate (A.D. 99) to conduct the prosecution of Marius Priscus, who had been proconsul of Africa, and was charged with various flagrant crimes. On this occasion Tacitus replied to Salvius Liberalis, who had spoken in defence of Priscus; his reply, says Pliny, was most eloquent, and marked by that dignity which characterized his style of speaking. (Pliny, *Ep.*, ii. 11.)

The contemporaries of Tacitus were Quintilian, the two Plinys, Julius Florus, Maternus, M. Aper, and Vipsanius Messala. He was on terms of the greatest intimacy with the younger Pliny, in whose extant collection of letters there are eleven epistles from Pliny to Tacitus.

In one of these letters (vi. 16) Pliny describes the circumstance of the death of his uncle, Pliny the Elder, and the letter was purposely written to supply Tacitus with facts for his historical works.

It is not known when Tacitus died, nor whether he left any children. The emperor Tacitus claimed the honour of being descended from him, but we have no means of judging of the accuracy of the emperor's pedigree; and Sidonius Apollinaris (*Ep.*, lib. iv., *ad Polemium*) mentions the historian Tacitus among the ancestors of Polemius, a praefect of Gaul in the fifth century of our æra.

The extant works of Tacitus are, 'The Life of Agricola,' 'The Treatise on the Germans,' 'Histories,' 'Annals,' and the 'Dialogue on Orators, or the causes of the decline of eloquence.' None of his orations are preserved.

The 'Life of Agricola' is one of the earliest works of Tacitus, and must have been written after the death of Domitian (A.D. 96). The Proemium, or Introduction to it, was written in the reign of Trajan, and the whole work probably belongs to the first or second year of that emperor's reign. As a specimen of biography it is much and justly admired. Like all the extant works of Tacitus, it is unencumbered with minute irrelevant matter: the life and portrait of Agricola are sketched in a bold and vigorous style, corresponding to the dignity of the subject. The biographer was the friend and son-in-law of Agricola, whom he loved and revered; but he impresses his reader with a profound conviction of the moral greatness of Agricola, his courage and his prudence, without ever becoming his panegyrist. The 'Life of Agricola' was not contained in the earliest editions of Tacitus.

The Histories, which were written before the 'Annals,' and after the death of Nerva, comprehended the period from the accession of Galba to the death of Domitian; to which it was the author's intention to add the reigns of Nerva and Trajan (*Hist.*, i. 1). There are only extant the first four books and a part of the fifth, and these comprehend little more than the events of one year, from which we may conclude that the whole work must have consisted of many books. Unfortunately the fifth book contains only the commencement of the siege of Jerusalem by Titus.

The 'Annals' comprehended the history of Rome from the death of Augustus to the death of Nero, a period of two and fifty years, which ended with the extinction of the Julian House in Nero. A part of the fifth book of the 'Annals' is lost; the seventh, eighth, ninth, tenth, the beginning of the eleventh, and the end of the sixteenth and last book are also lost. These lost portions comprehended the whole reign of Caligula, the first years of Claudius, and the two last years of Nero's reign. It is said that the preservation of the historical works of Tacitus is due to the emperor Tacitus (Vopiscus, *Tacitus*, 10), who caused them to be transcribed ten times every year, and copies to be placed in the libraries. But the works of Tacitus, and more particularly the 'Annals,' were neglected during the decline of the empire, and few copies of them were preserved. The first five books of the 'Annals' were not found till the beginning of the sixteenth century, when they were discovered in the abbey of Corvey, in Westphalia, and published at Rome, in 1515, by Philip Beroaldus.

The 'Germany' of Tacitus has been the subject of some discussion as to its historical value. The author does not inform us whence he drew his materials for the description of the usages of these barbarians, many of whom could only be known by hearsay even to the Roman traders and adventurers on the frontiers of the empire. The work contains numerous minute and precise details, for which it must be assumed that the writer had at least the evidence of persons conversant with the German tribes on the frontiers; and there is nothing in the description of Tacitus which is substantially at variance with what we know of the early Germans from other sources. The soundest conclusion is that the picture of the Germans is in the main correct; otherwise we must assume it to be either a mere fiction, or a rhetorical essay founded on a few generally known facts: but neither of these assumptions will satisfy a careful reader.

The Dialogue on the causes of the decline of eloquence may have been written in the reign of Vespasian: it is at least probable that it is an early work of Tacitus. It has been sometimes doubted if it is by Tacitus, but the style is in favour of the common opinion, though it presents in many respects a marked contrast to the 'Annals,' the work of his mature years. Messala, one of the speakers, attributes the decline of oratory to the neglect of the arduous method of study adopted by the older orators, who learned their art by attaching themselves to some eminent speaker, and by experience in the actual business of life: in Messala's time the school of the rhetorician was the only place of discipline for the young. But Maternus, another speaker, indicates more truly the causes of the decline of eloquence, by a reference to the political condition of the Romans and the suppression of their energies under the Empire, as compared with the turbulent activity of the republican period.

The 'Annals' of Tacitus are the work of his riper age, on which his historical reputation mainly rests. Though entitled Annals, and generally sufficiently true to the chronological order of events, the title of Annals conveys no exact notion of the character of this work. The writer moulded the matter of his history, and adapted it to his purpose, which was not a complete enumeration of the domestic and foreign events of the period, but a selection of such as portrayed in the liveliest colours the character of the Romans. The central figure in this picture is the Imperial power, and the person who wielded it, the Princeps, and every event is viewed in relation to him. The notion of the Romans of the age of Tacitus is inseparably associated with the notion of the government of one man. The power that had been founded and consolidated by Augustus, had been transmitted through many princes, few of whom had distinguished themselves by ability, and some had sullied the purple with the most abominable crimes. Yet the imperial power was never shaken after it was once firmly established, and the restoration of the old republic was never seriously contemplated by any sober thinker. The necessity of the imperial power was felt, and the historian, while he describes the vices and follies of those who had held it, and often casts a glance of regret towards the republican period, never betrays a suspicion that this power could be replaced by any other in the abject and fallen state of the Roman people. It is this conviction which gives to the historical writings of Tacitus that dramatic character which pervades the whole, and is seen in the selection of events and the mode in which they are presented to the reader. It is consistent with this, that the bare facts, as they may be extracted from his narrative, are true, and that the colouring with which he has heightened them may often be false. This colouring was his mode of viewing the progress of events, and the development of the imperial power: the effect however is, that the reader often overlooks the bare historical facts, and carries away only the general impression which the historian's animated drama presents.

Tacitus had formed a full, and, it may be, a correct conception of the condition of the empire in his own time, and the problem which he proposed to himself was not only to narrate the course of events from the close of the reign of Augustus, but to develop their causes. (*Hist.*, i., 4.) For his 'Annals' at least he could claim, as he does, the merit of strict impartiality: he lived after the events that he describes, and consequently had no wrongs to complain of, no passions or prejudices to mislead him. (*Annal.*, i. 1.) He observes also, in the commencement of his Histories (i. 1), that neither Galba, Otho, nor Vitellius had either conferred on him any favour or done him any injury. To Vespasian, Titus, and Domitian he acknowledges his obligations. The reign of Domitian is unfortunately lost; but we may collect from the expressions in the 'Life of Agricola' (43, 45, &c.), that the favours which Tacitus had received did not save this contemptible tyrant from the historian's just indignation.

The tone which characterizes the historical works of Tacitus is an elevation of thought which had its foundation in the moral dignity of the writer and the consciousness of having proposed to himself a noble object. He was a profound observer of character: it was his study to watch the slightest indications in human conduct, and by correctly interpreting these outwards signs, to penetrate into the hidden recesses of the heart. His power of reaching those thoughts which are often almost unconsciously the springs of a man's actions, has perhaps never been equalled by any historical writer. If any man has ever approached him in this power, it is Feuerbach, who ('Merkwürdige Criminal-Rechtsfälle,' that is, 'Remarkable Cri-

minal Cases"), while laying bare the inmost soul of a murderer, makes us shudder at the contemplation of enormities of which every man is capable. Tacitus had lived through a time when the value of the lessons of philosophy had to be tested by their practical application, and his historical studies carried him through a period in which the mass were sunk in sensuality, and the really good and great had no consolation but in the consciousness of their own thoughts. Though he appears to belong to no sect of philosophers, his practical morality was of the Stoic school, the only school which in those degenerate times could sustain the sinking spirits of the Romans, and which even under favourable circumstances guided the conduct of the wise Aurelius, the noblest man that ever possessed sovereign power. The religious opinions of Tacitus partook of the character of his age: he had no strong convictions, no settled belief of a moral government of the world: his love of virtue and his abhorrence of vice were purely moral; they had no reference to a future existence. (*Ann.*, iii. 18; vi. 22.) In one of his earliest productions he hopes rather than expects that the souls of the departed may still live and be conscious of what is passing on earth. (*Agric.*, 46.) But in his latest writings there are no traces that his hopes or his wishes had ever ripened into a belief.

The style of Tacitus, especially in his 'Annals,' is the apt expression of his thought: concise, vigorous, and dramatic. He has perhaps attained as great a degree of condensation as is compatible with perspicuity; sometimes his meaning is obscured by his labour to be brief. His historical works are especially works of art, constructed on a fixed principle, and elaborated in obedience to it. He loves to display his rhetorical skill, but he subdues it to his dramatic purpose. It is a fault that his art is too apparent, that his thoughts are sometimes imperfectly or obscurely expressed, that he affects an air of mystery, that his reflections on events are often an inseparable part of them, and consequently the impressions which it is his object to produce can only be rectified by the rigorous scrutiny of a matured mind. Yet those who have made Tacitus a study generally end in admiring him even for some of those qualities which at first repelled: almost every word has its place and its meaning, and the contrast between the brevity of the expression and the fullness of the thought, as it marks the highest power of a writer, so it furnishes fit matter for reflection to those who have attained a like intellectual maturity.

Tacitus must have had abundant sources of information, though he indicates them only occasionally. He mentions several of those historians who lived near his own time, as Vipsanius Messala and Fabius Rusticus: he also speaks of the memoirs of Agrippina and others. The Orationes Principum, the Fasti, the Acts of the Senate, and the various legislative measures were also sources of which he availed himself. It has been already intimated that the minute detail of events was often foreign to the purpose of Tacitus, and accordingly he is sometimes satisfied with giving the general effect or meaning of a thing without aiming at perfect accuracy. Thus we cannot always collect with certainty from Tacitus the provisions of the Senatus-consulta of which he speaks; and for the purpose of any historical investigation of Roman legislation, his statements must sometimes be enlarged or corrected by reference to other sources, and particularly to the 'Digest.'

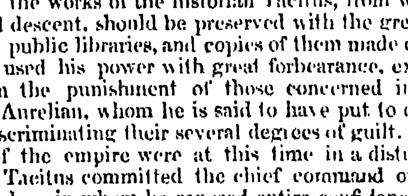
The first edition of Tacitus, which is extremely rare, was printed at Venice, in 1470, by Vindelin de Spira: this edition contains only the last six books of the 'Annals,' the 'Histories,' the 'Germany,' and the 'Dialogue.' The subsequent editions are very numerous. One of the best editions is that of Ernesti, by Oberlin, Leipzig, 1801, 2 vols. 8vo.: it contains the valuable notes and excursus of Lipsius, the best of all the commentators on Tacitus, and in his department one of the first of modern scholars. The last edition is by Immanuel Bekker, Leipzig, 1831, 2 vols. 8vo. There is a 'Lexicon Taciteum,' by Bötticher, Berlin, 1830, 8vo.

There are translations of Tacitus in Danish, Swedish, Dutch, German, French, Italian, Spanish, Portuguese, and English. The Italian translation of Davanzati is considered to be a model of condensed and vigorous translation. A French writer considers that his own language is perhaps best capable of representing the thoughts of the eloquent and ingenious historian, of emulating his precision, attaining his elegance, and aspiring to his energy (*Biog. Univ.*, art. 'Tacite'); an opinion which is perhaps not true. D'Alembert translated various passages from Tacitus. The English version of Murphy, which first appeared in 1793, is loose, diffuse, and feeble, and hardly expresses the meaning of the original: as a work of art, being a translation of a work which is above all other historical works characterized by its art, it is contemptible. Gordon's version, which appeared before that of Murphy, is a harsh and rugged version; but it is tolerably faithful to the meaning of the original, and was probably useful in helping Murphy to it.

For further information on the editions and translations of Tacitus, and on works in illustration of him, see Hain's *Repertorium*; and Schweigger's *Handbuch der Classischen Bibliographie*.

TACITUS, MARCUS CLAUDIUS, a Roman emperor, was the successor of Aurelian. After the interregnum of nearly seven months, which followed upon the death of that prince, the senate, by request of the army, met to elect an emperor. At the advanced age of seventy-five, Tacitus, then princeps senatus, was chosen unanimously, in spite of his unwillingness to accept a dignity too great for his declining years. The army confirmed the act of the senate, and the new emperor commenced his reign in September, B.C. 275, with the most favourable assurances from all classes of his subjects. Tacitus immediately instituted some salutary reforms relating to the coinage and other matters. He restrained the luxury of the times by sumptuary laws, and was himself an example of the greatest temperance, modesty of deportment, and single-minded magnanimity. He gave up his whole private fortune to the state, and introduced no change in his dress or way of life. He was of very studious habits, and gave orders that the works of the historian Tacitus, from whom he claimed descent, should be preserved with the greatest care in the public libraries, and copies of them made every year. He used his power with great forbearance, except perhaps in the punishment of those concerned in the murder of Aurelian, whom he is said to have put to death without discriminating their several degrees of guilt. The frontiers of the empire were at this time in a disturbed state, and Tacitus committed the chief command of the East to Probus, in whom he reposed entire confidence.

The Scythæ, or Goths, pretending that they had been summoned by Aurelian to aid him in his Persian war, made an irruption at this time from the Palus Mæotis into Pontus and Cappadocia.



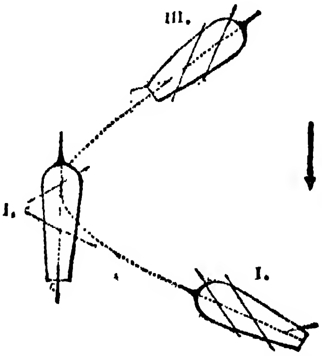
Coin of Tacitus.
British Museum. Actual size. Copper. Weight, 54½ grains.
(The C after IMP denotes Cæsar.)

Tacitus proceeded thither in person with his brother Florianus, and having first tried conciliatory measures, compelled them to retire by force of arms. His reign, commenced with such fair prospects, was now prematurely and abruptly terminated. He had appointed Maximinus governor of Syria, who treated his subjects with such cruelty, that the magistrates of the towns in that province, aided by those yet surviving of the murderers of Aurelian, conspired against him and killed him. Despair of pardon led them to commit a greater crime, and they formed designs against the life of the emperor, who fell a victim to their treason at Tyana in Cappadocia, after a reign of about eight months, in the spring of the year 276. According to one report, he died of disease, harassed by seditions; but the statement of Zosimus and Zonaras, that he was murdered by the conspirators, seems entitled to greater credit. After his death, his brother Florianus seized the empire, but was put to death two or three months afterwards. Gibbon attributes to Tacitus many of the measures introduced at this time to revive the power of the senate. It is certain that he showed great deference to that body; and when they refused to make his brother Florianus consul because the time of election had expired, he expressed himself pleased with their frankness. The coins of Tacitus record his victory over the Scythians by the inscriptions

Victoria Gothi and Victoria Pontica; see also Gruter, cxcii. 5; and for his Life—Vopiscus, in the 'Historia Augusta;' Zosimus; Zonaras; Aurelius Victor, *De Vit. et Mor. Imperat. Roman.*; Tillemont, *Histoire des Empereurs*, iii.; Gibbon, ii.

TACKING is an operation with the rudder and sails, by which, when a ship is proceeding in a course making any acute angle with the direction of the wind on one of her bows, her head may be turned towards the wind so that she may sail on a course making nearly the same angle with its direction on the other bow.

In order to accomplish this motion, the sails being braced, as at I., so as to allow the ship to have as much velocity as possible in her actual direction, the helm is turned a-lee, as it is called, when the force of the water on the rudder, together with that of the wind on the mizen-sail, causes the ship gradually to turn her head towards the wind. By this motion the planes of the main and fore sails are brought in the direction of the wind, when they begin to shiver, and soon afterwards they are taken aback, or the wind presses them against their masts. In this state the mainsail is braced round to the opposite side of the ship, as at II., and the action of the wind on the foresail, while it arrests the forward motion of the ship, turns her head round from the direction of the wind so as to bring the latter upon the other bow: the foresail is then braced rapidly round on the other tack, that is, parallel to the new position of the mainsail, as at III., when it is immediately filled by the wind, and the ship proceeds in the new course; the action of the wind on the mizen sail, together with that of the water on the rudder, preventing her from falling too far from the direction which she is required to take.



TACQUET, ANDREW, a mathematician of some celebrity, who was born at Antwerp in 1611. He entered at an early age into the order of the Jesuits, and was one of the many members of that body who distinguished themselves by the works which they composed for the advancement of the sciences. He held the post of professor of mathematics during fifteen years, and died December 23, 1660.

Tacquet published at Antwerp, in 1651, a work in 4to., in four books, on the sections of cylinders and on the figures formed by the revolutions of segments of circles; and to these books he added a fifth in 1659. In the year 1655 he published, in 8vo., 'Elementa Geometriæ planæ ac solidæ, quibus accedunt ex Archimede theoremata;' and, in the same year, 'Arithmeticæ Theoria et Praxis accuratè demonstrata.' These two last works appear to have been for a long time in use in the schools of the Jesuits.

A collection of the principal works of Tacquet was published at Antwerp in 1669, in two folio volumes, under the title of 'Opera Mathematica demonstrata et propugnata à S. L. &c.' Among these works are Astronomiæ libri octo; Geometriæ Practicæ libri tres; Opticæ libri tres; Catoptricæ libri tres; Architecturæ Militaris liber unus; Cylindricorum et Annularium libri quinque; and Dissertatio de Circulorum Volutionibus.

In the treatise on astronomy, the author, in conformity to the system of Ptolemy, considers that the earth is immovable at the centre of the universe; but it is thought that he adopted this supposition less from a conviction of its truth than through deference to the authority of Riccioli, whose work he follows, and through an unwillingness to admit the hypothesis of Copernicus on account of its contradiction to the letter of certain passages in the Scriptures. In the work on cylinders, &c. he determines the superficies and volumes of bodies formed on cutting a cylinder by planes in different directions; and he investigates the surfaces and volumes formed by the revolutions of different segments of circles and of the conic sections about axes in given positions: the reasonings are conducted by geometrical processes agreeably to the methods then recently introduced by Cavalieri and Gregory of St. Vincent. In treating the theorems selected from Archimedes, Tacquet assumes, in order to diminish the length of the demonstrations, that regular polygons may be inscribed within and described about circles, till at length their areas and peripheries differ respectively from those of the circles by magnitudes less than the least that can be assigned: then, considering the polygons and circles as identical, he obtains the ratio of the peripheries of the circles and the equivalent for their areas: by assuming also that there may be described about a sphere a polyhedron whose surface shall differ from that of the sphere by a magnitude less than the least that can be assigned, he determines both the volume and the superficies of the latter. Archimedes had demonstrated that the volume and superficies of a sphere are to those of a circumscribing cylinder in the ratio of 2 to 3; and Tacquet, by such assumptions as those above mentioned, proved that the same ratio exists between the volumes and superficies of a cylinder and of an equilateral cone, when both are described about the sphere.

TACTICS (τακτικός) properly signifies the art of forming the troops of an army, or the ships of a fleet, in order of battle, and of making changes in the dispositions of either according as circumstances may require.

Under the word STRATEGY it has been shown that previously to the commencement of active warfare, it is necessary to occupy one fortified place or more near the frontiers of an enemy's country for the purpose of placing there in security the magazines of an army, and of receiving support in the event of being obliged to retire. And as an army in quarters now generally occupies a considerable extent of country, it would evidently be advantageous to have a fortified place on each of its flanks, in order to prevent the enemy from getting to the rear without making a circuitous march of such extent that ample time would be allowed for counteracting the project. The fortresses occupied by an army constitute the *base*, and the roads by which it is to advance to the immediate seat of war are called *lines of operation*.

In Europe, an army while in the field can draw much of its support from the country in which it is acting, and therefore it does not always wholly depend upon its magazines for the means of subsistence; yet even in this part of the world the supplies of provision and forage which can be obtained in an enemy's country are often precarious, and an army without a regular communication with its depôts is in danger of being reduced to the necessity of surrendering in order to avoid being starved. Such a disaster is still more likely to overtake an army engaged with the people of the East, if unprovided with the means of support in itself, since there the military force of the country consists chiefly of swarms of light cavalry, who, avoiding regular engagements, hang continually upon the invaders, both preventing supplies from arriving, and cutting off all parties who may be beyond the protection of the main body.

A single line of operations is considered unfavourable, unless it be at all seasons secure against the enterprises of the enemy, since the latter, if he be in the vicinity, may attack the columns on their march or may intercept the convoys on the road. A like objection applies to lines of route at considerable distances from each other, since the troops moving on them may not be able to support each other in the event of those on any one road being attacked. Lines of operation proceeding from points near the centre of a base line, and lying between others which may be in the possession of the enemy, are called interior lines; and these are always favourable both for the troops during their marches and the security of the convoys. Roads proceeding from the extremities of a base are called exterior lines; and troops moving on such roads, particularly if the enemy occupy any part of the ground between them, are more liable to be attacked than those whose

routes lie on interior lines. Diverging, or, as they are called, eccentric lines, proceeding from any one point or more in a base may be considered as advantageous for offensive operations, since by them bodies of troops may be rapidly moved up at once to different points in an enemy's line; and if compelled to retreat from such points, they will gradually approach towards each other: they will thus be enabled to unite at some point in the rear, and afford each other mutual support. It should be observed however that such lines ought not to have a great degree of divergence, especially when there are few or no cross roads of communication, since then the columns in their advance may become so far separated as to be in danger of being cut off in detail; and the like objection is applicable to diverging, or eccentric, lines of retreat.

During the campaign in Russia, in 1812, the armies of Barclay de Tolli and of Prince Bagration retired from Smolensko, one by the St. Petersburg road and the other by that of Moscow: they became thus separated so far as to be unable to support each other, and had the French emperor been aware of the circumstance, it is probable that both of them would have been annihilated. Fortunately for Russia, Barclay succeeded, by a long and hazardous march through cross roads, in rejoining his colleague. On the other hand, it must be observed that concentric, or converging, lines of operation in rear of an army are sometimes unfavourable for a retreat: the Prussians, after the battle of Jena, suffered a severe augmentation of their disasters by the two divisions of the army, which had been unconnected during the action, becoming intermingled in their retreat, so that a state of inextricable confusion ensued.

In the campaign of 1809, the British and Spanish armies were compelled to act on what are called double eccentric lines of operations: for Lord Wellington was on the line of the Tagus, having Lisbon for a base, while Venegas with a Spanish army was employed in La Mancha; and there were besides the forces in Gallicia and Leon. The armies, being thus separated from each other, were quite unable to co-operate for one object, even had the Spanish generals and armies been capable of executing any combined operations.

The manner of reconnoitring ground, of selecting positions, and of performing the details of military manœuvres, have been described under Reconnoissance, Military Positions, and Evolutions Military; and, in the present article, it is intended only to explain the principles of tactics with relation to the marches of armies, the general movements on a field of battle, and the conduct of a retreat.

Marches comprehend all the movements by which an army transports itself from one place to another: when they are made at the opening of a campaign, and at a considerable distance from the enemy, they are called *routes*; and on such an occasion the object generally is to invade a country, to seek subsistence, to surprise the enemy or force him to make countermovements, in executing which he may be advantageously attacked. During a campaign, and in the enemy's sight, marches are made in order to attack some important position which he may occupy, or succour some post which he may threaten, or in order to fall back on the magazines of the army. At the end of a campaign an army marches to the quarters which it is to take up for the winter.

When an army already encamped in order of battle is to advance towards the ground directly before it, the march is said to be to the front; and if it is to proceed to ground on the right or left of the line, the movement is called a flank march. In the former case it would be advantageous if there were several roads nearly parallel to one another, and all tending to the position which is to be occupied; and it would even be proper, should there not already exist a sufficient number, to make such, by cutting through woods or walls, forming causeways over marshes, or bridges over streams. The army might then be divided into several short columns, so as to be able with facility, if suddenly attacked, to deploy into line at any moment either during the march or on arriving in the new position: the intervals between the lines of route should therefore be, as nearly as possible, equal to the extent which the columns moving in those lines would occupy when formed in order of battle. The advanced guard, consisting both of infantry and cavalry, may march before the head of the centre column at the distance of about a mile; and these troops should be accompanied by the pontoons, and the sappers who are to remove the obstacles, or form the bridges. When the French army advanced into Russia, in 1812, it marched in three great columns nearly abreast of each other: the centre column proceeded along the main road; and the country being one vast plain, the others with their artillery moved over the ground on both sides.

On a flank march along nearly parallel roads, since the heads and rears of the columns are where the extremities of the wings of the army would be if in order of battle, the several lines of route should be as near together as possible, that the troops may readily move into their proper places in re-forming the line; and it is obvious that, in such marches, the divisions in each column should be well closed together; for should they become separated by rivers, marshes, or any other obstacles, the enemy might seize the opportunity to attack a division before it could be supported by the others.

The difficulty of returning rapidly to the order of battle when attacked, is the reason that flank marches in the presence of an enemy are dangerous, particularly when the ground offers no impediment to his approach: they however become necessary when a position is to be taken up on either extremity of an enemy's line; and in order that they may be executed with safety, the columns should be protected in flank by a corps appointed for the purpose. In general an effort is made, by false demonstrations, to deceive the enemy, for a time at least, respecting such movements: these consist in opening roads in different directions through woods or enclosures, in laying bridges over streams, in sending provisions and stores, and even bodies of troops, to various points; and, while the enemy is in a state of uncertainty concerning the object of the demonstrations, the columns secretly commence their march: care however is to be taken that detachments, when sent out as feints, do not proceed so far from the army as to be cut off, or compelled to retire with great loss.

In the usual order of march the artillery should be formed in divisions corresponding to those of the troops, in order that each column may have a portion attached to it, and ready to act with it in the event of being obliged suddenly to come to action independently of the rest of the army. A few pieces of artillery generally accompany the advanced-guard in order to protect the deployment and commence the action; and a division composed of the heaviest pieces may move with the cavalry for its support. During the march, the place of the artillery is in rear of the column to which it belongs, that it may not impede the movement of the troops; that of the reserve artillery being behind the centre column, in order that it may readily move up to the position in which it is to be employed. If some point of attack has been previously decided on—if, for example, it is intended to commence an engagement by assailing a village or an intrenchment—a considerable division of the artillery must accompany the columns destined for that purpose; and if the army while making a flank-march is likely to be attacked on the road, some artillery proceeds at the head of each division of the troops. Should an attack in such circumstances take place, the troops must form as quickly as possible, and the artillery must be placed where it may serve to repel the assailants by its fire.

If an extensive movement is to be made in order to arrive at the position of the enemy, it is necessary to be careful that the latter may not, by short routes, attack the army on the march. This manœuvre was successfully performed by the Prussians at Liegnitz in 1760: the king, being surrounded by the Austrians and Russians, and in danger of being overwhelmed, on learning that the corps of General Loudon was moving to turn his left and fall on his rear, while other troops were to attack him in front, suddenly decamped, leaving troops and artillery to occupy the attention of Marshal Daun in front, and defeated Loudon on his march: by this action he opened a communication with Breslau, and caused the siege of Schweidnitz to be raised.

In all marches the breadth of a column must depend upon that of the road, and space should be afforded for the officers and orderlies to pass by the side of the troops without inconvenience: care should be taken, when any

change is made in the breadth of a column previously to entering a defile, that the formations be made without allowing the troops to fall into confusion.

To force a defile which is occupied by an enemy possessing artillery, and covered by epaulemens, is an undertaking which is likely to be attended with some loss: but if it is necessary to attempt it, the troops which guard its entrance should be dispersed by a fire of artillery; and then the infantry of the army may enter the defile protected by light troops and artillery placed on the slopes or summits of the heights, in situations where their fire may act with effect against the enemy's position, or against the posts which he may occupy. These detachments must be followed by reserve troops, by whom they may be strengthened, or on whom they may retire if repelled. The enemy is thus, if possible, to be driven from every post by which the defile, with its parallel or transverse passes, if such there be, is flanked; when the main body of the army may dispose itself in the position which shall appear most favourable for maintaining possession of the ground while the enemy remains in the neighbourhood: strong detachments must also be placed in situations which may command every approach to the flanks of the defile.

The operations to be performed at the commencement of an offensive war will depend in part on the form of the frontier: if this be convex towards the enemy, it may be considered as favourable for the operations, since the invading army setting out from its quarters, which may be supposed to be at the centre of the curve, may then march on roads nearly in the direction of the radii towards the points of attack, while the enemy will be compelled to act on the periphery of the curve by long lines of communication, and consequently his troops will be obliged to make fatiguing movements in order to arrive at the points which are to be defended. In the event of having penetrated into the enemy's country, some strong posts should be secured, in order that they may serve to protect the succeeding operations. Fortified places are usually on rivers, or in situations from whence cross-roads diverge into the country; and the possession of even one such place would be advantageous, as a depôt for artillery and stores, while the rivers or roads would facilitate the conveyance of supplies to the army.

On the other hand, in order to defend or cover a country, an army should be posted so that by short movements it may reach the enemy; and it must be understood that, in acting on the defensive, the corps of troops should not be stationed at great distances from each other, in the expectation of being able to defend every point which may be menaced by the enemy. This error was committed at the opening of the campaign in 1809, on the advance of the Austrians in great force towards the frontiers of France; when General Berthier so separated the divisions of the French army, that all of them might have been separately defeated, had the movements of the Archduke Charles been more rapid than they were.

When two armies are in the neighbourhood of each other, an engagement, either general or partial, may take place: the latter usually consists in an attack on one wing, or on some advanced part of the enemy's line, in order, by driving it back, to obtain a more advantageous position, or to secure some line of communication. A general action may become necessary when an invasion of a country is to be prevented, when a besieged fortress is to be relieved, when the position occupied is to be defended, or when that which is occupied by the enemy so far obstructs the communications as to deprive the army of the means of subsistence. A battle may also be hazarded if the position of the enemy be disadvantageous, if the divisions of his army are ill supported, or if his force is weakened, either from some part being badly covered, or from considerable detachments having been made.

An army drawn up for parade is usually disposed in two lines, with the infantry in the centre of each, and the cavalry on the wings; but this is far from being the case on service, since the nature of the ground will frequently render a contrary disposition necessary: in some parts of the field the troops may be in a single line, in other parts in two, or even in three lines.

The order of battle immediately previous to an engagement depends so much on the facility which the ground may afford for disposing and moving the troops, that it is scarcely possible to assign any rule for the formation; yet it is usual among military writers to class all the different dispositions of an army under two kinds, which are designated the *parallel* and the *oblique* order. The first comprehends all dispositions in which the troops of both armies may be engaged at once along the whole of their fronts: it was very generally employed by the Greeks and Romans, and during the middle ages: but it is now seldom adopted, since the weaker army is in danger of being outflanked; and should any part of it be driven back, the rest of the troops would either be turned and thus cut off, or be also compelled to retire. The battle would therefore be lost; and, being closely pursued, the defeated army incurs the risk of being entirely ruined. At the battle of Talavera, July, 1809, the two armies were drawn up in parallel order, and the attack was made by the French at the same time on the centre and on both wings of the allies.

The oblique order of battle may be said to have been employed by the antients when it was intended to break the enemy's line: on such occasions the phalanx was drawn up in the form of a wedge, and it advanced with an angle in front against the centre of the line. At the battle of Arbela, the army of Alexander attacked only the right wing of the Persians; and at the battle of Cynoscephalæ, the consul Flaminius, ordering one of his wings to remain on the ground which it then occupied, advanced with the other against the army of Philip. (Polyb., ex. 3, lib. 17.) But this order of battle was first employed on sound military principles by Frederick III. of Prussia.

It does not always consist in drawing up an army in a straight line, which, if produced, would meet the line of the enemy; for this, on account of the inequalities and accidents of the ground, is seldom possible: nor are the two wings of an army always placed at unequal distances from those of the enemy, though this is frequently the case. The principle of the oblique order consists in such a disposition of the troops as may enable a portion of the army to engage at some one point in the enemy's line, while the rest, protected by the obstacles of the ground, is stationed so as to be able to support the troops engaged, or prevent the enemy at other points of his line from attacking those troops in flank; and a great commander will always manœuvre so that his army, even though inferior on the whole to that of the enemy, may be superior in strength at the point of attack.

The attack is generally directed against one of the enemy's wings in the hope of being able to turn it, that is, to get beyond its extremity, or in its rear, and thus to cut off its retreat or intercept its supplies; but if the wings are well protected by the ground, or by intrenchments, or by strong reserves being posted there, and if at the same time the centre has been weakened by troops having been drawn away, or by those which form it being widely disseminated, the attack may be advantageously made against that part of the line. At the battle of Corunna, January, 1808, the British and French armies were in oblique order, the right of the former being near the left of the latter; while the opposite extremities were, by the nature of the ground, kept at a considerable distance from each other. The French made a charge with two strong columns, one of which advanced towards the British centre, and the other attempted to turn its right: in order to take this last column in flank, a part of the British army was placed obliquely to the line; and its fire, together with that of the reserve, which was moved up to the support of the right wing, prevented the success of the manœuvre. At the battle of Eckmühl (1809), Napoleon with his right wing attacked and defeated the left of the Austrians: by this success he cut them off from Vienna, and compelled them to retire towards Bohemia. Again, at the battle of Borodino, in 1812, the French attacked the Russian army at its centre and on its right wing, and succeeded in gaining the heights in that part of the position, after having suffered immense loss in storming a redoubt which protected them, and which was gallantly defended by the élite of the Russian infantry.

Whatever be the order of battle, a strong reserve of troops is necessary in order that any part of the army may be succoured by it when weakened by losses, or when in danger of being overpowered by numbers. At the [illegible] of Albuera, the timely bringing up of the reser[illegible] troops the first line was destroyed, was the means of [illegible]

being gained; and at the battle near Bayonne, December, 1813, two British regiments having been improperly withdrawn from an important position, that position was in danger of being lost, when General Hill brought up the reserve and maintained the action. Strong reserves are particularly necessary when armies engage on a plain, as then the whole of a line may be forced into action, and in the event of being defeated, its ruin would be inevitable without the support of a numerous body of troops.

When cavalry commence an action, its charge should be preceded by a fire of horse-artillery placed on one of its wings. The fire of that artillery should at first be directed against some part of the enemy's line which is at a distance from the point to be attacked; and if the latter point should be weakened by troops being withdrawn from it to strengthen that point against which the fire is directed, the artillery and cavalry immediately move rapidly forward: the former, having discharged some rounds of grape-shot, retires, and the cavalry is left to execute its charge. Should the artillery become mixed with the combatants, it would be in danger of being taken by the enemy, whereas, being kept in reserve, it may after the charge either join in the pursuit or protect the retreat.

Infantry generally commences an attack by a fire of light troops; and these are accompanied by a part of the artillery, which joins in the firing, the rest remaining in reserve. If the skirmishers retire in order to allow the first line of the army to engage the enemy, the reserve artillery is brought up with that line, and it disposes itself by the side of that which had previously been in action, or it goes to one of the wings. Should the enemy's line become disordered, the horse-artillery gallops up to within range of grape-shot, and completes the victory.

The stations of artillery in position should if possible be such that the fire of the guns may converge towards some battery of the enemy, in which case the fire of such battery against those guns is necessarily divergent. In general when an army acts on the offensive, the lines of fire from batteries in position should form nearly right angles with the front of the position, in order that the attacking columns may have room to form in the intervals between those lines of fire: but if the enemy be the assailant, the lines of fire may form acute angles with the position, in order that he may be thereby annoyed when nearly in contact with the troops; the fire of the artillery being directed against the points where the enemy's troops are in masses, as against the heads and flanks of the columns of attack. The guns should not however be placed in position till they are wanted, in order that they may be as little as possible exposed to the fire of the enemy; and if any battery is subject to a heavy cannonade, another should be immediately placed in a situation where its fire may cross that of the first battery on the ground occupied by the enemy's guns. When placed on elevated ground, the guns in a battery should be able to defend all the slope of the height up to them; and when that is not possible without bringing them so near the brow as to be exposed to the view of the enemy, other guns should be placed where their fire may flank the ascending ground.

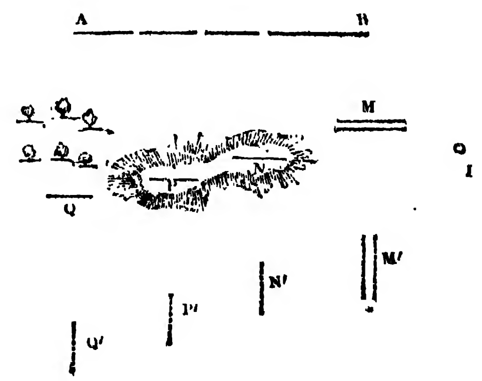
Artillery consisting of 9-pounder guns are found most convenient for the batteries which are placed with the troops: such guns are capable of serving to defend the position, and they may be employed to destroy walls, displace abatis, or ruin field intrenchments. Howitzers are also used in the field for the purpose of throwing shells into redoubts or villages, or among troops protected by hedges, hollow ways, &c., where the shot from gun-batteries could not take effect. Horse-artillery should be kept with the reserve, and be ready to advance wherever it may be required, either to support a part of the line which is likely to be forced, or to gain the flanks or rear of the enemy; and when it is required to get possession of a position before the enemy can arrive at it, the horse-artillery, on account of the rapidity of its motion, may be employed for the purpose.

The batteries by which an army is protected in its position constitute a sort of bastions, being usually placed a little in advance of the infantry of the line. If the army receives the attack of the enemy, the artillery commences action by a cannonade while the enemy is at a distance; and if the army acts on the offensive, the artillery guards the columns of attack. It is usual, when guns are fired in position, to direct them so that the shot may strike the ground in front of the enemy's line, and afterwards by rebounding make a series of grazes among his troops. When the ground is hard and even, these ricochets are very destructive; but if soft, or much broken by inequalities, the shot plunges in the ground and does comparatively but little execution.

The best proportions for the quantity of artillery in an army is one gun for every 500 men (infantry), and one gun of the horse-artillery for every 250 men (cavalry).

Armies, whether on the offensive or defensive, are generally kept in columns till the proper moment for deploying has arrived; for by this disposition both parties are enabled to conceal their projects from each other till one of them has determined to commence the action, and each is in a condition to make such movements as may be necessary in order to give him an advantage over his opponent. The Spanish General Cuesta was blamed for having, at the battle of Medellin (1809), in which he was defeated, advanced towards the French army in one weak line three miles long; when by keeping the troops in columns he might have moved them between the enemy's divisions, and thus, by separating them from each other, have destroyed them in detail. If a position is such that the army occupying it is exposed at several points to be attacked, those points should be occupied by small bodies of troops, the bulk of the army being kept behind in columns ready to march to any point where their services may be required. Thus the enemy will be embarrassed from the impossibility of determining the force of the army at any one point; and his only chance of success will lie in the quickness of his movements. The circumstances which may determine a general to attack a position at any particular point, are the appearance of that point being weak on account of troops or artillery being withdrawn; from the ground being there more easy of access than elsewhere, or from its capabilities of affording cover to troops in their advance.

If an army, as AB, in position on level ground, is to be attacked on its left wing B, the army acting against it is usually placed en échelon, as at M, N, P, Q, each division consisting of a battalion or a brigade; and this formation



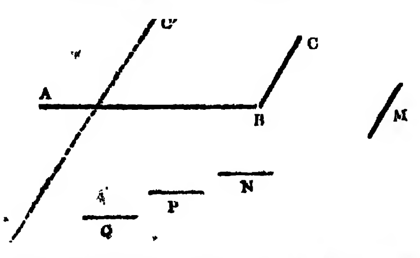
may be accomplished by moving up the different columns, as at M′, N′, P′, Q′, to the places which, when deployed, they are to occupy during the engagement. It would be advantageous however that the heads of the columns should remain till the moment of deployment in a line parallel to that of the enemy, in order to keep the latter as long as possible in suspense respecting the real point of attack. A favourable moment is then chosen for bringing the greatest mass, as M′, to the wing at B, which is supposed to be the weakest part of the line, but it should be observed that this intention will succeed only when the different columns can be moved to their stations with great rapidity; for if the enemy has time to perceive the manœuvre, he will not fail to take measures to counteract it. The échelons must always lie so near one another as to allow them to be mutually supported, yet not so near to the enemy as to be in danger of being forced into action. In order to explain the process of turning an enemy's position, let it be supposed that the left wing B of his line is in a plain, and not well protected by works; and consequently that it may be turned, while the right wing A is covered by woods. Strong columns are formed

at M, in order to perform the manœuvre of turning the flank B. The divisions at N and P constitute the centre, and may be supposed to be on elevated ground so as to be refused to the enemy; while Q may consist of a small division extended along the skirts of the wood merely to keep the enemy in check.

Should the enemy reinforce his left B, by drawing troops from his right A; and should this circumstance become known after the troops M have set out on their march towards B, the infantry of the column M may then change their route and proceed towards N and P, concealing their strength as much as possible by passing through woods and hollow ways, if such there be, while the cavalry, supported by some infantry in a village, as at I, move towards M as before, in order to deceive the enemy. The central columns P and N then move towards their left, and unite with the troops Q to attack the wing A. Thus the disposition of the army is completely changed; and if the change is effected with rapidity, the enemy might not have time to reinforce the wing A before it would be turned. If the troops in the wing B were to advance to attack the central columns at P and N, and these were to retire, those troops would be unable to produce any effect, as it would be necessary to recall them in a short time on account of the danger then threatening the right wing.

This is nearly what took place at the battle of Leuthen (1757), when the king of Prussia advancing against the Austrian army, made demonstrations as if he would attack their right wing. Marshal Daun, though for a time he suspected the feint, was at length deceived and sent all his reserves to strengthen that wing: the king observing this, proceeded immediately to execute an oblique attack; for which purpose his columns moved rapidly to the right and deployed on the left wing of the Austrians: this wing gave way, and the right wing wheeling up to attack the Prussians' left, the two armies were brought into parallel positions. These movements produced in the Austrian line disorder and openings by which the Prussian cavalry penetrated and took possession of the village of Leuthen: the Austrians rallied twice afterwards, but they were finally obliged to retreat. At the battle of Albuera (1811) the French general at first moved his columns as if he intended to attack the left of the allies, but soon causing them to change the direction of their march, he rapidly placed nearly two-thirds of his army in order of battle perpendicular to the right of the British line. By this movement the allies were obliged to change their front, and, as this was done under a heavy fire, the enemy was upon them before they had time to complete the new formation.

When an army, in the position AB, is attacked on one wing as B, by the corps M, and is in danger of being turned, it may endeavour to prevent the success of the manœuvre by throwing back that wing in a direction BC,



parallel to that of the attacking corps M: this is called forming the army *en potence:* the angle B is however weak, for the troops in BC by falling back may become crowded and disordered; AB may become exposed to a raking fire from M, and BC to a like fire from troops at N. It is evident however that M cannot now turn the flank BC without making a circuitous movement, by which it may become separated from the rest of its line: and if the army AB is strong enough, it may form a line parallel to the direction of CB. By such a movement the parallel order would be restored, and the wing A might even be made to turn the left, Q, of its opponent: this should of course be attempted, as the return to a parallel order of battle leads to no useful result. In order to effect it, the division BC should retire gradually, while the brigades in AB wheel back, in order to keep in connection with it; at the same time the brigades at A wheel to their front so as to form the new line A'C', in a direction oblique to that of Q, P, N.

An attack on an enemy's line is often made by a strong division drawn up in one column for the purpose of forcing its way through the line at some point where it appears to be weak, and thus compelling the different corps to retire that they may not be separately overwhelmed. This is the mode of attack which was practised with so much success by Napoleon against the Continental armies, but which failed when attempted against the British troops both in Spain and at Waterloo.

It is adopted when an attack is to be made on an enemy behind retrenchments, in which case the troops move as much as possible towards the salient angles of the work in order to avoid the direct fire; it is also necessary when the ground only permits the troops to advance on a narrow front, as in defiling through a ravine: in fact, if an enemy's position have obstructions in its front, it must necessarily be attacked in columns if at all. The columns should be connected with each other by bodies of light troops, and the attack should be made with a view of separating a wing of the enemy from his main body.

The attack in column possesses some advantages over one made by troops deployed in line while the men remain steady in the column; for the enemy is intimidated by the sight of a vast body coming against him, while the assailants feel confidence from their union. A rapid succession of efforts directed against troops in a slender line will also, in general, succeed in breaking their order; but there are several circumstances which more than counterbalance these advantages: during the advance over uneven ground the men lose their ranks and fall into confusion; the flanking fire of the enemy's artillery makes great havoc among the crowded masses, and the columns can only oppose this fire by an irregular fire from its sides; disorder then ensues, the commands of the officers are no longer regarded, and an attempt to deploy for the purpose of making an attack in line only completes the disorganization. An attack in column can, indeed, scarcely succeed unless it were preceded by a heavy fire of artillery: this will put the enemy's line in disorder; and in the event of forcing it, the column may then be deployed in order to secure its advantages.

If a line, nearly equal in strength to that of the opponent, on being attacked in column, were to stand firmly, it is probable that the attack would fail; and even if the line were penetrated, the troops, by forming themselves in hollow squares, disposed chequer-wise, so that their fires may cross on the ground in their front, have invariably been found capable of resisting the efforts of the assailants. This last manœuvre was recommended by General Jomini, and was for the first time employed at the battle of Aspern, in 1809. In that action Napoleon perceiving the Austrian line to be weakened in the centre, ordered it to be attacked by the whole corps of Marshal Lannes, which for this purpose was drawn up in one great column. The column, preceded by artillery, advanced rapidly, and succeeded in penetrating the line. The troops in that part gave ground, but forming themselves in squares, they resisted all the efforts of the French cavalry to disperse them, while the wings of the army closing upon the flanks of the column poured into it a destructive fire of artillery, which at length forced it to retire in confusion between the two fortified villages which supported its wings. The attack of the French at the battle of Wagram had however complete success: the Austrians, being doubtful of the precise spot at which Napoleon would cross the Danube, had very widely dispersed their troops; the centre of their line was particularly weak, and against this part the French emperor determined to direct a dense column: this was composed of the reserve of the army, and the charge was preceded by a heavy cannonade which still further dispersed the Austrian troops. The army, being thus broken, was compelled to retreat. At the battle of Talavera (1809) the French in strong columns attacked at the same time the centre and both wings of the British line: the latter was drawn up three deep, and its fire of musketry and artillery directed against the heads and flanks of the columns, aided by charges of cavalry, drove the enemy back with great slaughter: an indiscreet pursuit made by the Guards was the cause of much disorder in the centre, and the enemy returning to the charge, that part of the line was completely broken; but fresh troops

being ordered up to the spot, their fire kept the enemy in check till the disordered troops rallied, and the artillery continuing to play on the flanks of the enemy's columns, the latter at length gave way.

The success of an action is often promoted by sending out a detachment with directions to fall on the flanks or rear of the enemy during the engagement: the sudden appearance of a body of troops in such a situation cannot fail to produce embarrassment in the army which is attacked, and to diminish the energy of its operations towards the front. On the other hand there is some danger in sending out large detachments from an army, as it is seldom possible to afford them due support; and therefore they may be cut off by the enemy. The distance which the detachment has to march, together with the state of the roads on which it must move, should be ascertained with precision, in order that it may be at the appointed post at a seasonable moment, and such determinations are very uncertain, particularly if the corps has to make a great circuit. It almost always happens that the detachment arrives too late for the accomplishment of the object; and this was the case with a detachment sent by the king of Prussia during the action at Torgau (1760), with a view of turning the left of the Austrians and cutting off their retreat.

Detachments are however constantly sent out to protect the parties reconnoitring a country, to guard a convoy, or to support a foraging party: in these cases its object is less to fight than to cover a retreat; therefore the troops advance with circumspection, and retire when the enemy appears in superior force. During the war in Spain (1813), Colonel (Sir Frederick) Adam having been detached to occupy a post at Ordal, ten miles in advance of the army under Lord William Bentinck, in Catalonia, was suddenly attacked by the French army, and his troops dispersed: this misfortune is ascribed to neglect in not having placed outposts, by which warning might be obtained of the enemy's approach.

An army which gains an advantage over its adversary is always more or less deranged by the action, and it is necessary that it should endeavour to recover its order preparatory to receiving the second line of the enemy, should the latter advance to renew the combat. On the enemy retiring, the first line of the victorious army advances, and then the second line follows it in order to support it, sending, if necessary, battalions or squadrons to replace such as have been much disordered during the action. In the event of the second line, or reserve, of the enemy being defeated, since then there is no apprehension that the action will be continued, companies of troops may be detached in pursuit of the retreating army; but every precaution should be taken to keep them within the support of the main body, and particularly to prevent the troops from dispersing for the purpose of plundering the country. The advance of the whole army in pursuit should continue so long only as it can be conducted with order, and in masses strong enough to oppose the enemy if his troops should rally in a good position. If disorder should take place among the pursuers, the latter should be made to fall back on the reserves: the pursuit of a retreating army can, indeed, be seldom continued beyond the first elevated ground at which the latter may arrive; since, however little discipline it may preserve, it may there rally and return to the order of battle. The consequences of the actions at Jena and Waterloo are exceptions to this rule, because the vanquished armies were at those places too completely disorganized to allow them to make any attempt to rally.

When the success of an action begins to be doubtful, and it is apprehended that the army must retreat, some of the heaviest artillery should be drawn off to a good position on heights, or behind streams or hollow ways, while the lighter artillery remains engaged: the first line of the defeated troops is then made to pass through the intervals of the second, or of the reserve, while the latter continues the action. The first line should remain in order of battle in rear of the second, till the latter is enabled to retire; and this alternate retreat of the lines should be continued till the army can be thrown into columns of march, when the retreat may be protected by detachments of light troops. In general the retreat should be made in one body, as thus it can more easily protect itself against the enemy in pursuit: if however the centre is broken, the army may be obliged to retire by different and even by diverging routes; and provided there are in the rear strong posts by which it may be protected, the risk of being cut off during such a retreat is small.

When there are narrow defiles in rear of the field of battle, the retreat through them becomes extremely dangerous, for the army may be overtaken before it can get through; and if they are already occupied by the enemy's detachments, the retiring army may be annihilated, or compelled to surrender. It has been observed that the situation of the British army at Waterloo would have been very critical if it had been compelled to retreat; for in its rear there was only one road by which it could have retired. In order to pass a defile in safety, it ought to be previously occupied by troops: artillery and a reserve corps should also be stationed so as to defend the approaches on the advance of the enemy towards them.

If, when not in action, an army is to retreat from a position which it occupies, the movement is usually concealed from the knowledge of the enemy, and, for this purpose, it frequently takes place at night. On such occasions the outposts remain at their stations as long as possible; and fires are left burning on the ground, as if the army were still in the position: after it is dark the main body moves off, and the rest of the troops follow by degrees.

The approach of winter, and the necessity of taking repose after the fatigues of a campaign, render it necessary for armies, whether on the defensive or otherwise, to take up positions where they may remain during the season of inaction. These positions, called winter-quarters, should be chosen by the commander of the army on the offensive, so that he may be able to preserve the ground which he has gained; and by him who is on the defensive, so as to be secure against the attacks of the enemy. The principles by which a choice of quarters is determined are the same as those which regulate the occupation of ground for a field of battle. The quarters should be covered in front and on the flanks by rivers or other natural impediments to the approach of an enemy, or by forts constructed for defence.

A great extent of ground in front is therefore a disadvantage, as some part may be ill-guarded, and liable to be surprised, and the troops will be too much disseminated. If it is traversed by great roads perpendicular to its front, it is also disadvantageous, as the enemy may then easily march into the quarters.

Several battalions of infantry and squadrons of cavalry are quartered in villages along the front of the position: the whole or a division of a company or of a squadron at each place: these posts may be strengthened by redoubts, palisades, or abatis; retrenchments also should be executed, to defend roads by which the enemy may approach, and bridges over the streams should be destroyed. The troops in each of these stations furnish the men necessary to constitute the advanced posts of the chain. A stronger force should occupy villages and towns within the first chain, and from these are sent such bodies of troops as may be requisite to support those in their front. The great body of the troops ought to be near a central point of the position, in order that succours sent from that body may easily reach any part that may be threatened.

When an army is in quarters, there are established alarm-posts, at which the troops should be appointed to assemble. These are frequently in the vicinity of a fortress, that the corps may be protected by the latter till all have assembled; but they should be in commanding situations, that, in the event of the enemy attempting a surprise, his movements may be easily seen. Each division, or corps of the army, should have its own alarm-posts, and there should be, besides, the general place of rendezvous for the whole army: the latter place should be so situated that all the divisions may be drawn up there before the enemy could arrive at it, and it should be protected by a fortress which may contain the provisions for the support of the troops.

A system of signals, for day or night, is determined on, by which intelligence may be conveyed to all the different posts, of the approach of the enemy. Should an alarm be given by any outpost of the chain, the bodies of troops which are appointed to support that post take arms, attach the horses to the artillery, and prepare to march immediately to the point of danger; but the judgment of

the commander, and the information which he may receive from spies or deserters, must enable him to form an opinion whether a demonstration made by the enemy is true or false.

(Bulow, *Esprit du Systeme de Guerre Moderne*, 1801; Guibert, *Œuvres Militaires*, 1803; Jomini, *Traité des Grandes Operations Militaires*, 1811, with the continuation; Rogniat, *Considérations sur l'Art de la Guerre*, 1817; Lallemand, *Traité des Operations Secondaires de la Guerre*, 1825.)

TACTICS, NAVAL. This branch of the art of war is in some respects similar to that by which the operations of armies on land are regulated: the 'orders' preserved by ships in sailing correspond to those of a land march on a plain, and the orders of attack in both services may alike be divided into *parallel* and *oblique*.

The antients, previously to the commencement of a naval action, drew up the ships in each fleet abreast of each other, and in that order one of the fleets moved on, or waited for the attack: for each ship being propelled by oars, and armed with a beak of iron or brass projecting before the bows, efforts were generally made to direct it so as by an oblique impulse to destroy the oars on one side of a ship of the enemy, and thus render it unmanageable, or so as with the beak to pierce a side, and thus sink the ship; and hence, in the antient manœuvres, each commander always endeavoured to keep the prow of his ship presented to the ship which was opposed to him. But since the employment of gunpowder in naval warfare, each ship in two hostile fleets is manœuvred so as to bring one of its sides to bear against the bows or against a side of its opponent, in order that it may have the power of pouring into the latter the greatest quantity of fire; and since it is the object of both commanders to avoid being raked, a general action can take place only when the hostile fleets are drawn up in two lines parallel to each other, the keels of the ships in each being in the direction of the line. In the treatise of Père L'Hoste on naval evolutions, this mode of engaging is said to have been first employed at the battle of the Texel (1665), when James II., then duke of York, commanded the English fleet.

The order of sailing for a fleet should obviously be such that the several ships may be as near together as possible, both for the sake of mutual support, and that the signals which may be made by the admiral may be distinctly seen: it depends also necessarily on the order of battle, since it is of importance that the fleet should be enabled, with the utmost facility, to pass from either of these states to the other.

Writers on naval tactics distinguish five different orders of sailing, the wind continuing to blow in one direction, and the keels of the ships remaining constantly parallel to one another; in other words, all the ships steering the same course. The first order is that in which all the ships are abreast of each other in a line perpendicular to the direction of the wind; and the second is that in which the ships are arranged so that a line joining all their mainmasts is oblique to that direction; but in this order the line may have two different positions with respect to the wind, for each ship may be on the starboard (the right hand) side, or on the larboard (left hand) side of that which is to leeward of it. As in either of these two dispositions each ship in the line has that which is next to it on one side, opposite to one of its bows, and that which is next to it on the other side, opposite one of its quarters, this order of sailing is frequently called the *bow and quarter* line. In the first and second orders, if the ships are numerous, the line is inconveniently extended.

The third order of sailing is that in which, all the sails being *close-hauled*, the ships are formed in two lines making with each other an angle of about 12 *points*, or 135°; the admiral's ship being in the centre.

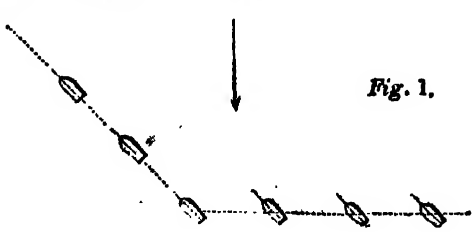


Fig. 1.

N.B. By the expression close-hauled is to be understood such a disposition of the sails that the ship may advance as nearly as possible towards the part of the horizon from whence the wind blows. In general, the line of direction of the wind makes then, on the side next to the ship's head, an angle of about 6 *points*, or 67° 30′, with a vertical plane passing through the keel; and, on the side next to the ship's stern, an angle of about 2 *points*, or 22° 30′ with the plane of the sails.

The fourth order is that in which the ships, steering with the wind on one and the same *quarter*, are formed in several lines, divisions, or squadrons, and as much concentrated as possible. The ships of the commanders are ahead of the several divisions, and a line joining the mainmasts of all the ships in each is supposed to be in the direction of the wind. This order is very convenient for a convoy, but it presents great difficulties to the formation of the line of battle. In the fifth order, the fleet, if not very numerous, is divided into three squadrons, the ships of which sail in as many parallel lines: if numerous, each squadron may be divided into two or more parts, so that the whole may constitute six or nine parallel lines, the number of ships being equal in all. The ships in this order are supposed to be close-hauled, and the keel of each ship coincides with the direction of the line to which it belongs, or the ships of each line sail in each other's wake; while the corresponding ships in the different divisions may be either abreast of each other or in bow-and-quarter position. A line drawn through the mainmasts of the corresponding ships in the different divisions may be supposed to coincide with the direction of the wind. This order of sailing is that which is considered the most advantageous on account of the facility which it affords for forming the line of battle. Generally, the fleet consisting of three divisions, the vanguard of the line constitutes the weather division, and is commanded by the vice-admiral; the centre division is commanded by the admiral himself; and the leeward or rear division, by the rear-admiral. If the fleet consists of more than three divisions, those which are not commanded by the admirals are under the direction of commodores, or senior-captains, and each commander is in the centre of his own line: frigates, store-ships, &c. are kept to windward of the line of battle-ships.

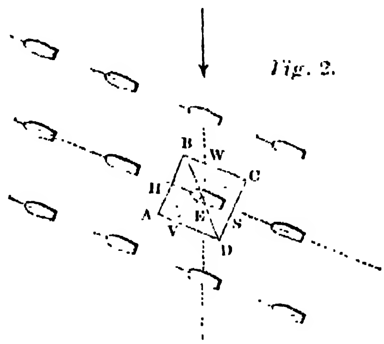


Fig. 2.

The first and second orders of sailing are easily formed, however irregular may be the previous dispositions of the ships; for the ship which is appointed to lead in the formation may get to leeward of the whole fleet, and then hauling her wind (disposing her sails so that she may move in a line making the given inclination to the direction of the wind), she may sail in the proposed direction: the other ships then, according to their positions, follow successively in her wake, and when all are proceeding in one line, each veers [VEERING] or bears away, steering in the prescribed course, and still preserving the general line. The third order of sailing is formed after all the ships have got into one line, steering in each other's wake as above mentioned, and the line making an angle of about 10 *points*, 112° 30′, with the direction of the wind (reckoning from the latter direction towards the bows of the ship). The van ships, which are those to leeward of the admiral, who is supposed to be in the centre, succes-

sively haul their wind and steer in the proposed direction; and when the admiral's ship has hauled her wind, the sternmost or windward ships do the same, and each proceeds in a direction parallel to that of the other ships. The fourth and fifth orders of sailing are formed by the leading ships of the different divisions getting abreast of each other, or in bow-and-quarter position, at the prescribed distances; and then the ships of the respective squadrons taking their places in each other's wakes.

In the orders of sailing, the distance of one ship from another, in line, should be such that any danger of running foul of each other may be avoided: in general that distance may be considered as equal to two or three cables' length (each = 120 fathoms). And, with respect to the distances between the several lines in the fifth order of sailing, it has been determined, the ships being close-hauled, by supposing that a line joining the headmost ship of one of the leeward divisions, and the sternmost ship of the next division to windward, should be at right angles to the direction of the wind; or that the angle which such line makes with each division should be equal to 2 *points*, or 22° 30′. In general this interval may be considered as equal to six or nine cables' length; and it is of importance that the distances prescribed by the admiral of the fleet should be strictly preserved.

In order that the commander of any one ship may readily ascertain and preserve his relative position in a fleet when in order of sailing, the ingenious device called the *naval square*, which was invented by Père L'Hoste, may be employed. It consists in tracing upon the quarter-deck a great square ABCD (diagrams No. 2 and 3), having two sides, AD and BC, parallel to the ship's length: the diagonals AC and BD intersecting each other in E, and the line HES being drawn vertically over the ship's keel; also the point H being towards the head of the ship. Now, if a ship were sailing in the direction SH, close-hauled on the starboard tack, as in the cut No. 2, hat BD coincides with the plane of the sail, and WE (bisecting the angle HEC) with the direction in which the wind is blowing; then, after having tacked and become close-hauled upon the larboard tack, since the directions of the vertical planes passing through the keel and sail make angles with the direction of the wind equal to those which they made before tacking, the line SH, that is, the line on which the ship will be sailing, will coincide with, or be parallel to, the position of EC in the diagram. In like manner, if a ship be sailing in the direction SH, close-hauled on the larboard tack, so that AC coincides with the plane of the sail, and VE with the direction in which the wind is blowing; then, after having tacked and become close-hauled on the starboard tack, the line SH on which the ship will be sailing will coincide with or be parallel to the position of ED in the diagram.

Hence, if a fleet be in three parallel divisions, the ships sailing abreast of each other, those in each line will be in the direction SH, and the corresponding ships in the different divisions will be in the directions AB or DC. If the fleet sails close-hauled, and, for example, on a starboard tack as in No. 2, the ships in each line will be in a direction coincident with or parallel to SH, and the corresponding ships in the several lines will be in a direction coincident with or parallel to WE, which is that of the wind. Again, if the fleet is in three divisions, and the ships are sailing in parallel directions not coinciding with those of the divisions; if, for example, the ships should be sailing on the larboard-line of bearing while close-hauled on the starboard tack, as in the subjoined diagram, the ships in each line will be in the direction of one of the diagonals of the square; and the corresponding ships in the different divisions will be in that of the other.

The order of battle consists in the ships being drawn up in each other's wake, or in one right line with which the directions of all their keels coincide: they are usually about 50 fathoms from one another, and are nearly close-hauled. The frigates, store-ships, &c. are in lines parallel to that of the line-of-battle ships, and on the side opposite the enemy. A line of ships close-hauled is particularly advantageous as an order of battle both for a fleet to windward, and also for that which is to leeward of its opponent. If a windward fleet were in any other state, the enemy might, by manœuvring, gain the weather-gage, or he might, by being able to approach as near as he pleased, compel the windward fleet to come to an action. And a leeward fleet which is close-hauled is always prepared either to take advantage of any change of wind in its favour, or to avoid an action. In a close-hauled line also, the sails are disposed so that the ships remain nearly stationary during the action; on which account the line is steadily preserved, and any ship on becoming disabled can be easily replaced by one of those which are in the reserve line.

When the ships of a fleet are in the first or second order of sailing, and it is intended to form the line of battle, it is evident that by simply hauling the wind, or by tacking [Tacking] or veering [Veering], as the case may require, the ships may get into each other's wake in any proposed direction of the line. If it be intended to form the line of battle from the third order, the ships in that wing which is already in a line, in the direction of their keels, must simply haul their wind and get into each other's wake in the proposed direction of the line; each ship in the other wing is then brought into a position nearly at right angles to the direction of the wind, and, as those of the first wing advance, these fall successively into their wake.

When the line of battle is to be formed from the fourth or fifth order, all the ships being supposed to be close-hauled, the formation may take place upon any one of the divisions; the ships of this division are then brought *to*, (their motion stopped by bracing some sails so as to be taken aback by the wind while others are kept full,) and the other ships are made to take up their proper positions in the prolongation of the line thus formed. If, for example, the fleet consists of ships sailing in three divisions close-hauled, and the line is to be formed upon the centre division, as in the subjoined diagram; then, as soon as this squadron is brought *to*, the ships in the weather division bear away and steer till they get ahead of the centre, when they haul their wind; the lee division tacks and sails on till it gets astern of the centre, and when these ships have hauled their wind the line of battle is formed. In this formation the weather division or column has been made to constitute the van, and the lee column the rear of the line; but it is sometimes thought necessary to make the columns change places, by causing that which

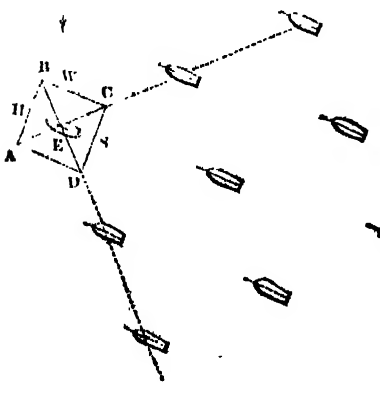


Fig. 3.

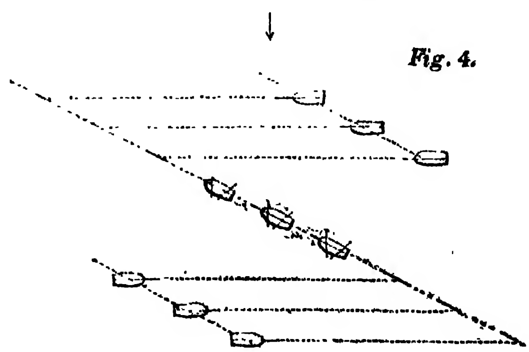


Fig. 4.

is on the weather side of the fleet to become the centre or rear column, or by making the centre or lee column constitute the van of the line. A like interchange of the places of the van, centre, and rear divisions is also, occasionally, made when the fleet is in the order of sailing; and various other evolutions are performed by the ships of a fleet, both while sailing and in the line of battle: the principal of these consist in the several ships tacking, or veering, in succession, and in turning to windward; and there are, besides, the series of movements which are necessary in order to restore the line of battle when disordered in consequence of a shifting of the wind. But the details of these evolutions can be studied with advantage only in works which are expressly written on naval tactics.

From the order of battle it is necessary to return to some one of the orders of sailing; and with respect to the three first of these, it will be merely necessary for the ships in the line to tack, or bear away, in the assigned directions, increasing or diminishing sail, so that they may arrive in their proper positions nearly at the same time. In returning to the fifth order of sailing, there are two cases, which consist in performing the manœuvres on the same and on the opposite tack. In the first case, should it be required that the van may become the weather squadron, the van and centre tack together and stand on, while the rear proceeds in its actual course; then, when the rear comes successively abreast of the centre and van squadrons, these re-tack, and thus three parallel columns are formed. In the second case, the van being to form the weather squadron, the ships in the van first tack in succession, then the ships in the centre, and lastly those in the rear. All then keep on, till the corresponding ships in the different squadrons get abreast of each other, when the order is formed. The evolutions differ, of course, from those just mentioned when the van is to form the lee, and when it is to form the centre squadron.

In the order of retreat before the wind, the ships are drawn up in two equal divisions, in lines making an angle of 135 degrees with each other; the admiral's ship remaining to windward of the rest of the fleet, and being at the angular point.

If a fleet is much superior in force to that of the enemy, it will be of little moment whether it comes to action on the windward or the leeward side; and each of these situations when taken, either by a fleet or a single ship, has both advantages and defects. The advantages of gaining the weather-gage, as it is called, are that in such a situation a fleet may approach that of the enemy, and it may commence the engagement when it shall appear most convenient: ships may be detached to the rear in order to turn the enemy's line and put it in confusion, and a ship may board its opponent almost at will: in firing also, the windward ships are but little incommoded by the smoke. On the other hand, the disadvantages of being to windward are, the difficulty of retreat without passing through the enemy's line; disabled ships cannot quit the line without disordering the rest of the fleet, and in stormy weather the lower-deck ports can seldom be opened. When a fleet is to leeward of that of the enemy, the ships which may be dismasted can be readily drawn away, and the whole fleet may retire if unable to contend against a superior force.

If a fleet to leeward of the enemy's line should attempt to gain the windward side, it should manœuvre so as to delay the engagement for a time in the hope that a change of wind in its favour may take place, and it must then endeavour to take advantage of such change. In these circumstances the commander must however keep the enemy in sight, or at least he must obtain a knowledge of his manœuvres by means of frigates detached for the purpose. If unable to succeed in getting to windward, it should be drawn up on a line as short as possible, in which case, that of the enemy being more extended, some of the ships in it must either take no part in the engagement, or, leaving their line in order to bear down, they will lose the advantage of the wind. On the other hand, a weather fleet should be manœuvred so as always to keep that which is to leeward quite abreast of it; since then, unless the wind should shift, it will continue to hold its position.

When it is desired to bring on an action against a fleet in line on the leeward side, the general rule is that the weather fleet should get abreast of the other, then bear down upon it till within the proper distance, and form in order of battle. Should the leeward fleet bear away at a certain angle with the wind in order to avoid the engagement, the other may bear away at a still greater angle; then, according to the relation between the distance of the fleets from one another and the extent of the weather line of ships, the latter will cut the other in some particular part of its length, and thus compel it to fight in disadvantageous circumstances. Again, if being to leeward of the enemy, it be necessary to avoid an engagement, the only resource is to bear away in order of retreat. If to windward, the fleet should, if possible, in retreating, keep constantly on one tack, in order to avoid the loss of time occupied in going about; but if from want of room it be necessary to change the course, the fleet may be kept on one tack during all the time that the enemy is on the other: for thus the two fleets will be constantly diverging from one another.

It is observed by Mr. Clerk, in his 'Essay on Naval Tactics,' that when an enemy's fleet is to leeward, and in that situation is to be brought to action, both fleets being in line of battle, if the ships in the weather-line bear directly down upon the others, those in the van are liable to be disabled in their rigging; and thus, their motion being retarded, disorder must ensue in the dispositions of the ships which follow them. Precisely the same disadvantages, he adds, attend the method of coming with the whole fleet, in line of battle, obliquely upon the line of the enemy; and to these faulty modes of attack he ascribes the damages which have so frequently been sustained by British fleets at the commencement of actions. The method proposed by that writer for coming to an engagement against a fleet to leeward is similar to that of an attack in oblique order on land, and consists in detaching a squadron for the purpose of attacking some of the rear ships in the enemy's line: the squadron should engage the ships broadside to broadside while the rest of the fleet is at a distance, prepared to send support if necessary. Then, should the van and centre of the enemy's fleet continue its course in order to avoid a general action, those rear ships will be taken: if any of the van ships should tack successively in order to support the rear, some other ships of their line will be in danger of being taken by a second squadron detached from the windward fleet; and if the whole line should tack together, the disorder thence arising might cause the loss of more ships, or might bring on a general action at a disadvantage to the leeward fleet. Lastly, if this fleet should veer, and bear away, the ships would become exposed to a raking fire in their retreat.

The manœuvre of doubling an enemy's line of battle consists in sending ships round by either of its extremities for the purpose of placing some of those in that line between two fires. In order to double a fleet, the ships should advance beyond its van, or fall in its rear, when by tacking or veering according as they are to leeward or windward of the line, they may get into the required position on its opposite side. It is right to observe however that this manœuvre ought to be attempted under favourable circumstances only, as the doubling ships are liable to be separated so far from their own fleet as to be prevented from rejoining it; and it is, on the whole, considered more advantageous to double a fleet by its rear than by its van, since in the event of some of the enemy's ships being damaged, and unable to keep up with the rest, such ships may be taken by those which are performing the manœuvre of doubling: should any of these last be separated from their fleet, they can remain in the rear without risk, till an opportunity is offered of rejoining it. At the battle of the Nile (1798), Admiral Nelson doubled the van of the French line, and attacked it on both sides, while the other ships of that line, the whole fleet being at anchor, could afford no assistance. In order to avoid being turned, the largest ships of a fleet ought to be in the van and rear of its line when in order of battle; and the rate of sailing for each should be such that the rear ships may never be astern of the enemy. Care should also be taken that the ships are as close together as possible, that the enemy may not pass between any two of them, and thus break the order of battle.

It is well known, from the records of naval history, that the manœuvre of cutting through the line of an enemy's fleet during an engagement has been several times performed by English commanders since the middle of the seventeenth century. In an action with the Dutch, in the year 1652, Sir George Ayscue is said to have charged from the leeward through the fleet of the enemy; and in that between the English and Dutch fleets in 1665, the earl of Sandwich cut through the centre of the Dutch line, and caused the disorder which ended in its total defeat: again in May, 1672, Sir Joseph Jordan, of the Blue squadron, having the advantage of the wind, pierced the Dutch fleet and threw it into confusion. But the action which first gave notoriety to the manœuvre was that in which Admiral Rodney gained the important victory over the French fleet commanded by the Comte de Grasse: this action was fought in 1782. The battle in which the brilliant career of Lord Nelson terminated with a decisive victory (1805) owed the success with which it was crowned to the employment of a like mode of attack.

The honour of having been the first to demonstrate fully the principles on which the manœuvres of an attack against fleets to windward or to leeward depend, is generally ascribed to Mr. Clerk of Eldin, who published the first edition of his 'Essay on Naval Tactics' in 1782; and it has been asserted (Playfair's *Memoir of Mr. Clerk*) that Clerk had, in conversation, communicated to Sir Charles Douglas (Rodney's flag-captain) his whole system of tactics in the year preceding that in which the battle with the Comte de Grasse was fought. The accuracy of this assertion has been however disproved by Sir Howard Douglas, in his 'Memoir on Naval Evolutions;' and from an account of the circumstances under which the manœuvre of breaking the French line was performed, as they have been given by Sir Charles Dashwood (one of Admiral Rodney's aides-de-camp on the day of the action), it appears that the idea of the manœuvre was, at the moment, suggested to the admiral by Sir Charles Douglas on perceiving an opening in the French line between two of the ships near its centre. The French fleet was formed in line on a larboard tack, and tended to gain the windward side of the British line, which from the leeward side advanced obliquely towards the fifth ship from the van of the enemy. Signals were then made for the British ships to close up in their line, and the action commenced as the two fleets ranged in opposite directions alongside of each other. When the centre of the British fleet came opposite the third or fourth ship of the French line, Admiral Rodney's ship began a close action within half musket-shot against the ships of the enemy with which it came successively abreast; and then the opening appearing as above mentioned, the opportunity was seized of passing through it: this was done so near the enemy, that the admiral's ship almost touched the French ship on each side. The ships astern of the admiral followed him closely, and these kept up a powerful raking fire against the ships in the rear division of the enemy's fleet, which, being driven to leeward as the van of the British fleet passed them, broke into two divisions, and made sail before the wind to escape. As soon as the van of the French fleet was left beyond the rear of the still advancing line of British ships, it also broke into two divisions, which retreated in different directions; and then the signal being made for the ships to close up, the British fleet followed in pursuit of that division with which the French admiral had retired. At the battle of Trafalgar (1805), the combined French and Spanish fleets were drawn up in one line, of a crescent form, the convex part being to leeward of the wings, while the fleet of Lord Nelson bore up against it in two lines, in the order of sailing: the leading ships of the lines broke through the fleet of the enemy in two places, and were followed by those of their respective divisions.

The manœuvre of breaking the line of a fleet, like that of attacking in column the line of an army, may not always succeed; and in the action, June 3, 1665, several squadrons passed through and through the Dutch fleet without gaining any advantage. If the line of the enemy is strong, the ships which would pierce it may be placed between two fires, or may be cut off from the rest of their fleet; and perhaps the manœuvre ought not to be attempted unless the line to be broken is already disordered by the action, or unless a favourable opportunity should present itself from negligence or want of skill in the enemy.

Should sufficient reasons exist for performing the manœuvre by a fleet which is to leeward of its enemy, the ships of that fleet should close up as much as possible, and by a press of sail get rapidly through the opening without attempting to engage the ships between which they pass; or each should give the fire of a broadside to one only, reserving the other broadside for the ship with which it is to engage in the new position: this position the ships should of course gain as soon as possible. On the other hand, an attempt to break the line of battle may be counteracted by causing all the fleet, as soon as some of the enemy's ships have got through, to put itself on the same tack as these; by which means some of them will be engaged between two fires, and others will be cut off from all connection with the fleet to which they belong.

When the commander of a ship intends with that ship to come to action with one of the enemy to leeward, he should bear down obliquely towards the latter till he gets nearly into its wake; and when at a proper distance, he may either run up alongside, or having shot a-head, veer and run down on the weather bow: the ship attacked should never be allowed to bring her broadside to bear except when both ships are in parallel positions.

In chasing an enemy's ship which is to windward, the chaser being presumed to sail better than the ship she pursues, it is recommended that the former should stand *on* close-hauled till abreast of the chase; she should then tack, and stand on close-hauled till again abreast; and so on. The ship chased, on the other hand, should, in order to avoid loss of time, continue constantly, if possible, on one course; but it is evident, from the supposed inferiority of her sailing, that she must at length be overtaken by her pursuer.

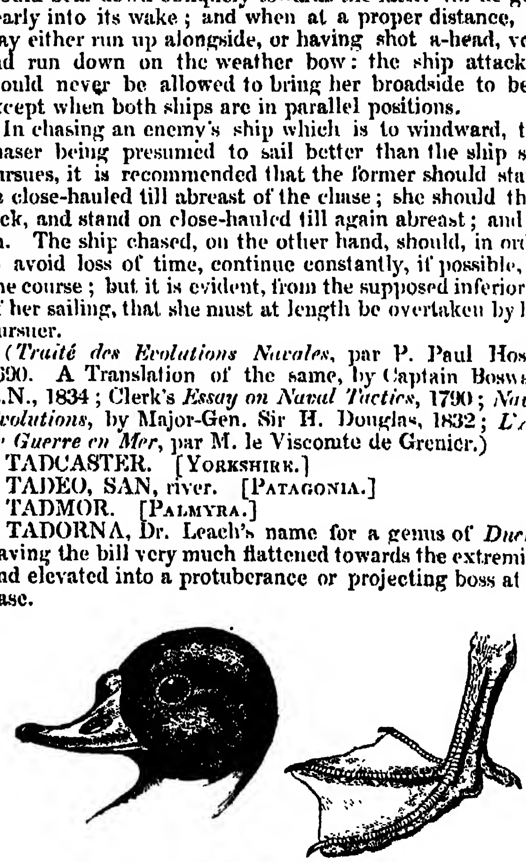
(*Traité des Evolutions Navales*, par P. Paul Hoste, 1690. A Translation of the same, by Captain Boswall, R.N., 1834; Clerk's *Essay on Naval Tactics*, 1790; *Naval Evolutions*, by Major-Gen. Sir H. Douglas, 1832; *L'Art de Guerre en Mer*, par M. le Viscomte de Grenier.)

TADCASTER. [YORKSHIRE.]

TADEO, SAN, river. [PATAGONIA.]

TADMOR. [PALMYRA.]

TADORNA, Dr. Leach's name for a genus of *Ducks*, having the bill very much flattened towards the extremity, and elevated into a protuberance or projecting boss at its base.



Head and foot of Tadorna.

Example, *Tadorna vulpanser*, Leach. [SHELDRAKE.]

TADPOLE. [FROGS; SALAMANDRIDÆ.]

TÆ'NIA (Tape-Worm). [ENTOZOA.]

TÆNIA. [MOULDINGS.]

TÆNIO'PTERA. [TÆNIOPTERINÆ.]

TÆNIOPTERI'NÆ, Mr. G. R. Gray's name for his second family of MUSCICAPIDÆ.

The *Tænioplerinæ* comprise the following genera:

Tænioptera, Bonap. (*Xolmis*, Boie; *Nengetus*, Sw.; *Blechropus*, Sw.; *Lanius*, Linn.; *Fluvicola*, Sw.; *Pepoaza*, Azara; 'Xolmus, Boie,' Sw.; *Tyrannus ?* Steph.; *Tyrannus*, 3rd div., Vieill.; *Muscicapa*, Spix; *Orsipus*, Norden).

Lichenops, Comm. (*Alla*, Less.; *Perspicilla*, Sw.; *Motacilla*, Gm.; *Sylvia*, Lath.; *Fluvicola*, D'Orb. et Lafr.).

Knipolegus, Boie (*Platyrhynchus*, Spix; *Blechropus* et *Ptilogonys*, Sw.; *Hirundinea*, D'Orb. et Lafr.; *Muscicapa*, Licht.; *Ada*, Less.; *Tænioptera*, Bonap.).

Fluvicola, Sw. (*Œnanthe*, Vieill.; *Entomophagus*, Pr. Max.; *Muscipeta*, Cuv.; *Xolmis* (Boie), Sundev.; *Platyrhynchus*, Vieill.

Arundinicola, D'Orb. et Lafr. (*Todus*, Pall.; *Platu*

…ynchus, Vieill.; *Alectura*, D'Orb. et Lafr.; *Muscipeta*, …uv.

Alecturus, Vieill. (*Alectura*, Sw.; *Yetapa*, Less.; *Xe…rus*, Boie; *Gallita*, Vieill.; *Platyrhynchus*, Spix; *…uscipeta*, Cuv.; *Muscicapa?* Steph.; *Muscipipra*, …ess.).

Gubernetes, Such. (*Muscicapa*, Licht.; *Tyrannus*, Cuv.).

Tæniopterinæ are placed between the *Querulinæ* …*Tyranninæ*. (*List of the Genera of Birds*, 2nd edition.)

TAFFI, ANDREA, born at Florence, in 1213, deserves mention as having been the first who introduced among his countrymen the art of painting in mosaic. Having heard of some eminent Greek artists who were executing paintings in mosaic in the church of St. Mark at Venice, he went to that city and formed an intimate friendship with Apollonius, one of the principal of those artists, and prevailed on him to accompany him to Florence, to teach him the best manner of working in mosaic, and the method of compounding the most durable kind of cement. On their arrival at Florence they executed together several works, which were highly admired. Taffi's chief performance was a Dead Christ, of large dimensions, in a chapel at Florence. He died in that city, in 1294, at the age of eighty-one.

TAFILET. [MAROCCO.]

TAGANROG is a town in European Russia, in the government of Ekaterinoslaf, near the north-eastern extremity of the Sea of Azof, in 47° 12′ N. lat. and 48° 40′ E. long. It stands on the summit of a lofty promontory, commanding an extensive prospect of the Sea of Azof and of all the European coast to the mouth of the Don. Azof itself is visible from the heights of the citadel in fine weather. It was founded in 1688, by Peter the Great, and became a very flourishing place till he was obliged to abandon it to the Turks by the peace concluded with Russia in 1711. Catherine II. intended to revive the plans of Peter the Great, but the works were not commenced and completed till the reign of Alexander. It is most advantageously situated for carrying on an extensive commerce, but the bay or road is so shallow that only ships of moderate burden can enter it, and even these must be lightened of part of their cargo at Kertsch or Feodosia. Besides this, it is only during a few months in the year that any trade can be carried on, because the Sea of Azof being frozen in the winter from December to March, the sea from the mouth of the Don to Taganrog is covered with such thick ice that sledges cross it in safety to Azof and Tcherkatsk. Notwithstanding these impediments the commerce of Taganrog is very great; for it is the chief place for all the intercourse between the provinces on the Donetz and the Don and foreign countries; the Volga too is so near, that goods are brought by land-carriage from that river at no great expense. The exports from Taganrog are corn, Siberian iron, leather, caviar, and fish. Previously to the year 1833, the number of merchantmen that arrived at Taganrog was between 300 and 400 annually. By a ukaze, issued in 1833, all ships liable to quarantine were prohibited from entering the Sea of Azof, and the number of arrivals is reduced to less than 100; notwithstanding this, the exportation to foreign countries has increased, the number of coasting-vessels being more than double what it was before. It must be observed that in speaking of the trade of Taganrog, that of the two neighbouring towns of Rostoff and Nakhitchevan is included, all the boats going to those three places being registered at one station. Taganrog has now about 17,000 inhabitants, chiefly Greeks, a gymnasium, ten churches, three of which are of stone, dockyards, large and numerous warehouses, and many very handsome private dwellings. The climate is temperate and remarkably healthy; the surrounding country is fertile, and produces excellent fruits and culinary vegetables; wheat sown in unmanured land yields from twenty to thirty fold. The vine and the mulberry flourish, but the country is destitute of wood. The emperor Alexander died here, on the 1st of December, 1825.

(*Odessa Journal*; *Conversations Lexicon*; Schnitzler, *La Russie, la Pologne, et la Finlande*; Lloyd, *Life of the Emperor Alexander*; Hassell; Cannabich; Stein.)

TAGUS, called *Tajo* by the Spaniards, and *Tejo* by the Portuguese, is the largest river of the Spanish Peninsula, which is divided between these two nations. The rivers by the confluence of which the Tagus is formed originate in the highest part of the table-land which occupies the interior of the peninsula, between 40° 25′ and 41° 5′ N. lat., and 1° 30′ and 3° 30′ W. long. In the elevated mountain-masses of the Sierra Molina and Sierra Albaraçin rise three rivers, the Molina or Gallo, the Tagus, and the Guadiela, which flow west-north-west between high ridges and in narrow valleys. The Molina and Tagus unite on the boundary-line of the provinces of Soria and Cuença, and, running south-west, they are joined by the Guadiela, where the three provinces of Cuença, Guadalajara, and Madrid meet. The united river continues to flow in a south-west direction until it enters the more open country of the plain, when it turns to the west, and is joined by the river Jarama, or Xarama. This river is formed by three rivers, which rise in the range that divides the table-land of New Castile from that of Old Castile, the Tajuna, Henares, and Jarama or Xarama. The last-mentioned river, the Xarama, is the most western, and originates on the Soma Sierra, near Buytrago. It runs south, and is first joined by the Henares, which flows south-south-west, and then by the Tajuna, which runs from its source to its mouth nearly parallel to the Henares and the Tagus, in the tract which divides those two rivers. The Tajuna joins the Xarama a few miles above its confluence with the Tagus. The country which is traversed by these branches of the Tagus is not much elevated above the watercourses, possesses a considerable degree of fertility, and is the most populous tract on the table-land of Spain. The Xarama joins the Tagus a little below Aranjuez, and at this place the river flows through a wide level plain very little elevated above its bed, and so fertile, that it is justly called the Garden of Castile. From this place the general course of the Tagus, as far as it lies within Spain, is nearly due west. Below Aranjuez the bed of the river gradually sinks deeper beneath the surrounding country: its banks are steep, and composed of rocks, which in some parts rise from the water abruptly to the height of 200 feet. The adjacent country is uneven and somewhat broken, but not hilly: but after having encompassed the hill on which the town of Toledo stands, the river again enters a level country, which extends for many miles westward, and in which it is joined by the rivers Guadarama and Alberche from the north. Below the town of Talavera de la Reina the Tagus enters a hilly country, where it flows with great rapidity in a deep bed filled with rocks, and is joined from the north by the rivers Tietar and Alagon, which descend from the high ridge that divides the table-land of the two Castiles. The Alagon originates in the icy masses which cover the summit of the Sierra de Griegos all the year round; and the volume of water which this river brings down is so considerable, that from the place of confluence at Alcantara the Tagus becomes navigable. Though the Tagus has run above 350 miles before it reaches Alcantara, no part of it is navigable, which is partly to be ascribed to the great rapidity of its current through the plain of Castile. Besides this, the greater part of its course is through narrow valleys, between steep hills, from which heavy masses of rocks have fallen down, which in many places greatly encumber the bed of the river, and cause rapids, which continue for several miles; but the greatest impediment to the navigation of the river is the small volume of water. The soil of the table-land absorbs a great quantity of moisture without forming springs, and at the same time the quantity of rain which falls on this region is much less than what falls in other parts of Europe; consequently the river is very scantily supplied with water, except during the few months when the rains are more abundant.

At Alcantara the level of the river is probably less than 300 feet above the sea, and it has still a course of about 200 miles to its mouth. Its course below Alcantara and as far as Abrantes, or rather the mouth of its tributary the Zezere, is nearly due west. For about 20 miles it constitutes the boundary-line between Spain and Portugal. In this part of its course the river is navigable, but the navigation is extremely tedious and not without danger, as the sandbanks are numerous and subject to change. It can only be navigated by small flat-bottomed boats. The Zezere, in which the numerous rivulets unite which collect the waters originating on the southern declivity of the

rocky masses of the Serra de Estrella, always brings a considerable volume of water to the Tagus, and from this point downwards the river may be navigated by vessels of 150 tons burden. In this part of its course numerous islands occur, which at first are small and rocky, but lower down are larger and alluvial. The larger islands are called Lizerias. Below these islands the river expands into a lake-like basin, which extends from north-east to south-west, in the direction of the course of the river, nearly thirty miles, and is mostly about twelve miles wide, but in several places it is narrowed to six miles by projecting headlands. The country north-west of the basin is covered with gently-sloping hills, the offsets of the Serra da Cintra, and on the south-east of it is the sandy plain of Alemtejo. The most western part of the basin constitutes the harbour of Lisbon, which is spacious enough to contain all the fleets of Europe. Where the town of Lisbon terminates on the west, the Tagus turns westward, and a broad rocky headland, consisting of high hills, advances northward, and narrows the basin to about one mile or a little more in width. At the same time the offsets of the Serra da Cintra come close up to the river on the north, so that the Tagus passes to the sea between two rocky masses. The whole course of the Tagus exceeds 550 miles, and the area of the country drained by the river probably does not fall short of 40,000 square miles.

Tagus is the name of this river in the Roman writers, which has been adopted in our language.

(Miñano's *Diccionario Geografico de España y Portugal*; Link's *Travels in Portugal*, &c.; Semple's *Observations on a Journey through Spain and Italy*, &c.)

TAIL, ESTATE. [ESTATE TAIL.]

TAIN. [ROSS AND CROMARTY.]

END OF VOLUME THE TWENTY-THIRD.

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